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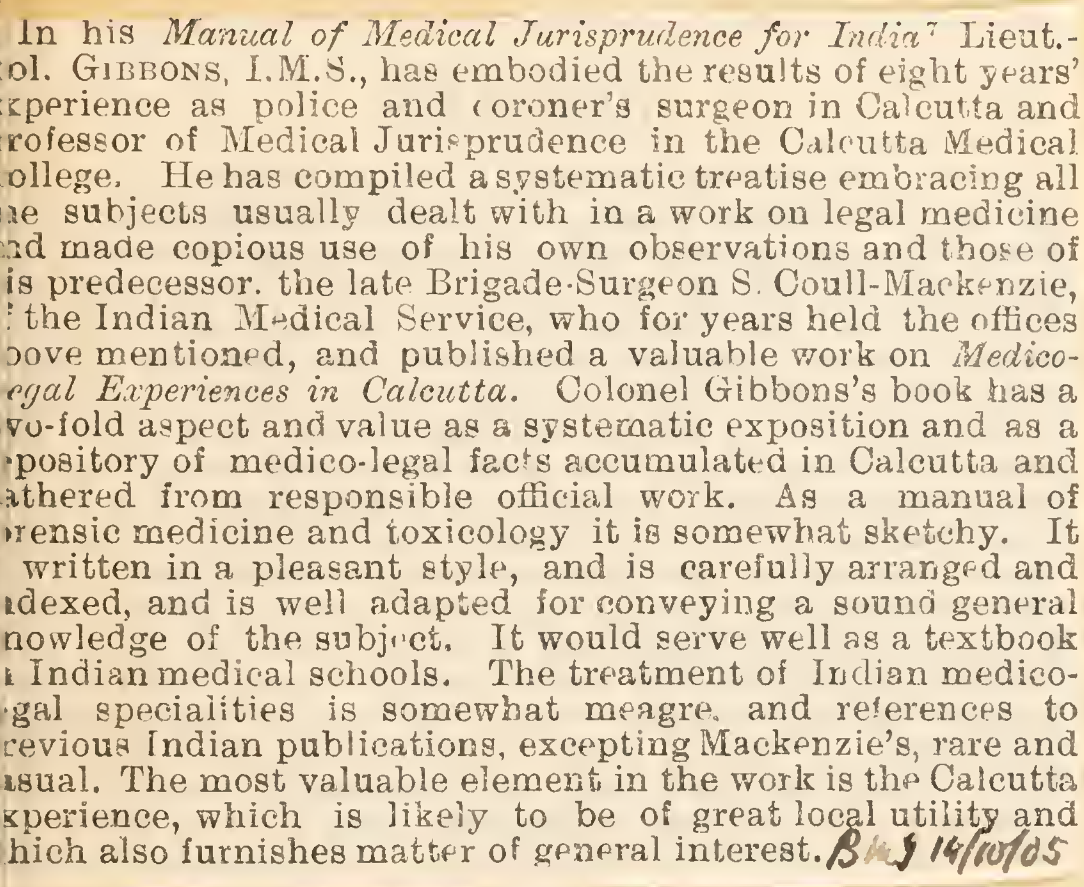
D. G. Crawford.
February 5th 1904

A MANUAL

OF

MEDICAL JURISPRUDENCE



In his *Manual of Medical Jurisprudence for India* Lieut.-
ol. GIBBONS, I.M.S., has embodied the results of eight years'
xperience as police and coroner's surgeon in Calcutta and
rofessor of Medical Jurisprudence in the Calcutta Medical
ollege. He has compiled a systematic treatise embracing all
ıe subjects usually dealt with in a work on legal medicine
ıd made copious use of his own observations and those of
is predecessor. the late Brigade-Surgeon S. Coull-Mackenzie,
the Indian Medical Service, who for years held the offices
ove mentioned, and published a valuable work on *Medico-*
egal Experiences in Calcutta. Colonel Gibbons's book has a
vo-fold aspect and value as a systematic exposition and as a
pository of medico-legal facts accumulated in Calcutta and
athered from responsible official work. As a manual of
rensic medicine and toxicology it is somewhat sketchy. It
written in a pleasant style, and is carefully arranged and
ıdexed, and is well adapted for conveying a sound general
nowledge of the subject. It would serve well as a textbook
ı Indian medical schools. The treatment of Indian medico-
gal specialities is somewhat meagre, and references to
revious Indian publications, excepting Mackenzie's, rare and
ısual. The most valuable element in the work is the Calcutta
xperience, which is likely to be of great local utility and
hich also furnishes matter of general interest. BMJ 14/10/05

, I.M.S.,
E,
UTTA, AND PROFESSOR OF
OLLEGE, CALCUTTA.

Printed and Published by
G. W. ALLEN & CO.,
3, WELLESLEY PLACE, CALCUTTA.

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PREFACE.

THE DESCRIPTIONS AND STATEMENTS in the following pages, except where otherwise stated, are based on the experience of eight years as Police and Coroner's Surgeon in Calcutta. In the general arrangement and manner of dealing with the different subjects, the author has mostly followed the Manual of Legal Medicine by the late Dr. E. R. Von Hofmann, Professor of Legal Medicine at Vienna; to that admirable work he is greatly indebted. He has also derived much valuable information from the late Brigade-Surgeon S. Coull.-Mackenzie's Medico-Legal Experiences in Calcutta. The author has also made use of the standard works on Medical Jurisprudence; he trusts he has, in every instance, duly mentioned the source of the information. To J. Hume, Esq., Government Prosecutor, the author is indebted for the report of the evidence of the Chemical Examiner and of the Police Surgeon in the trial, before the High Court, of a woman accused of poisoning her husband with arsenic. The report is likely to be of great assistance to medical witnesses, and also to members of the legal profession. In the Appendix will be found a series of questions devised for the guidance of magistrates in examining medical witnesses.

J. B. GIBBONS.

HOWRAH, January 1904.

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MEDICAL JURISPRUDENCE.

INTRODUCTION.

ALTHOUGH from a very early period in the history of civilized nations, medical knowledge appears to have been sometimes employed in the elucidation of legal questions, the origin of Medical Jurisprudence, as it is now understood, may be said to date only from the sixteenth century. In 1553, the Emperor Charles V. of Germany caused the publication of the Constituo Criminalis Carolina; early in the century, in 1507, the Bishop of Bamberg introduced a Penal Code, and in 1532, the Diet of Ratisbon adopted a uniform Criminal Code for Germany. In the Constituo Criminalis Carolina, the Magistrate is directed to obtain the opinion of medical men in cases where death was alleged to have occurred from criminal causes. In England the employment of medical men in criminal trials appears to date from the seventeenth century. It is possible that they were employed at an earlier period but the records are not definite on this point.

In the year 1678, a medical man was called for the defence at the trial of the Earl of Pembroke for murder. It seems that he was not examined on oath. His evidence regarding the appearances of the dead body may be taken as an index of the state of the knowledge of Morbid Anatomy, at the time. He said: "I viewed the body, my Lord, before, and when it was opened and could find no blackness or blueness...; upon which the body was opened and there issued thence clotted blood; then I looked upon the caul, which was withered and consumed, and the heart was loose as a rag, and his lungs stuck to each side of his ribs; and as to the matter of the blood, that was not an extraordinary thing, for it is known to physicians that in all natural deaths there must be extravasated blood in the lower belly."

It is difficult to imagine what foundation there was for this statement. What could have led physicians to believe that in all natural deaths there must be extravasated blood in the belly ?

About the same time, at the trial of the persons accused of the murder of Sir Edmundbury Godfrey, two medical men were called by the prosecution. The body of the deceased was found in a ditch, with a sword run through it, and bruises on the face, and a livid mark on the neck as if he had been strangled. The opinion of the medical men was that death was due to strangulation. One of them testified : "All strangled people never swell, because there is a sudden deprivation of the spirits and a hindering of the circulation of the blood." The accused were convicted.

The first recorded case in which the result mainly depended on the medical evidence occurred some years later than the cases mentioned. A gentleman was accused of murdering a woman by drowning. Medical men appeared for the defence and for the prosecution. The medical evidence regarding drowning and the floating of dead bodies was very conflicting. The Judge in charging the jury said, he could find no certainty in it, he left it to their consideration. The accused was acquitted.

During the last two hundred years medical knowledge has advanced enormously in every direction and in none more than in the recognition of the nature of the appearances found in dead bodies.

From the publication of the Constituo Criminalis Carolina the attention of Medical men was directed to the necessity for special study of medico-legal questions. Treatises dealing with the whole subject of Medical Jurisprudence or with portions of it, were published, in Italy, France and Germany. The first public lectures on the subject were delivered at Leipsic about 1650 ; early in the eighteenth century Professorships for the teaching of Medical Jurisprudence were established in the German Universities. The first systematic treatise by a British Author was published in 1788. The first lectures in Great Britain were given by Dr. Duncan, Senior, at Edinburgh, in 1801 ;

and Government appointed his son, Dr. Duncan, Junior, to the first professorship in 1803.

At the present time, the importance of Medical Jurisprudence is everywhere recognised; it is included in the curriculum of medical education and in the examinations of every University and licensing body. In all medical schools, the subject is taught by systematic lectures and demonstrations. In the medical schools in this country great attention is given to this most important subject and the opportunities afforded to the student of acquiring a practical knowledge, are not exceeded in any medical centres in the world.

MEDICAL EVIDENCE.

A medical man may be required to give evidence in a case, owing to his knowledge of certain facts concerning the subject matter of the trial or inquiry. He is put on oath and states the facts known to him, so far he has performed the duty of an ordinary or common witness, a witness to facts, and nothing more may be asked of him. But in most cases, he is also required to answer questions of opinion based on the facts which he has himself deposed to or which have been witnessed to by others, this duty places him in the position of an expert or opinion witness. The general rule in law, that the testimony of a witness is to be confined to a statement of facts and that he is not to be examined as to his opinions, has been so far altered that medical men and other persons possessed of special knowledge and experience in the subject matter of the inquiry may be asked to give their opinions on facts. The opinion evidence of experts is given on oath and is subjected to cross-examination.

When giving evidence, a medical man must keep in mind the difference between a common witness and an expert, and when stating facts, avoid giving opinions or drawing inferences. His duty as a witness to facts is to place before the court a full and accurate statement of the facts within his knowledge. If asked, but not otherwise, he must give his opinion, interpret or draw inferences from the facts.

"Every judicial proceeding has for its purpose the ascertaining of some right or liability," "all rights and liabilities are dependent on and arise out of facts." It is manifest that to enable a court to ascertain a right or liability, it must have placed before it the facts on which the right or liability depends, and if the facts or some of them are such that persons not possessing special knowledge are unlikely to form a correct judgment on them, the law permits witnesses possessed of that special knowledge to give their opinions and to act as interpreters of the facts. For this reason when medical witnesses testify to medical facts in a case, they are also required to give their opinion and to answer questions of opinion regarding the medical facts. Not infrequently in cases in which the medical facts are important, medical men who have no personal knowledge of the facts are called to give expert or opinion evidence.

The procedure adopted to elicit the opinions of experts is to put to them questions on certain assumed facts, hypothetical questions. The following is an example of this method of questioning: Suppose a person had between 6-30 and 7 o'clock drunk a cup of milk and immediately vomited, and after vomiting he retired and laid down and talked, telling stories for from one to one and a half hours after taking the drink, do you think that the drink could have contained 42 grains of arsenic or any fatal dose? It will be observed that the questioner assumes as proved various facts stated by witnesses in the case, and on them bases the question put to the expert.

This method of eliciting the opinions of experts has been adversely criticised and it certainly appears objectionable. Counsel, in formulating his questions, assumes as proved the statements made by the witnesses on his side. The answer of the expert, on which, as a rule, great reliance is placed, is based on these assumed facts, and as the Counsel combines what assumed facts he chooses, the answer will usually be in his favour. In cross-examination the expert has to answer more hypothetical questions based on a different combination of assumed facts; it is not astonishing that the answers frequently have the appearance of contradicting those first given.

Moreover, each side is allowed to employ expert witnesses who, before appearing in Court, are questioned and answer the questions framed by their employers. If their answers are unfavourable, they are not called, but that can seldom occur as the questions are based on facts which the questioner selects and assumes to be proved. The expert appears in court, is put on oath and is examined by his side, the questions he has already answered, are put to him. His opinions, however, are sifted and corrected by cross-examination.

Under the existing procedure for employing expert witnesses it is not extraordinary that the opinions of men of equal knowledge and experience called by each side in a case, should generally be contradictory, the opinions of the expert are based on one-sided hypothetical questions drawn up by the Counsel of the side by which he is called.

It is to this system of calling experts as witnesses for one side that the disrepute into which expert evidence has fallen, is mainly due. The expert is a party witness and not infrequently he descends, in most instances, unconsciously, to the position of a medical advocate for the side of his employers. In India this is seldom seen, but the records of trials in England often exhibit a most extraordinary conflict of medical expert evidence not only as regards matters of opinion, but even when the experts have had the opportunity to ascertain facts for themselves. An example will be found in the report of the medical evidence in a suit for damages by a man suffering from the effects of a railway accident, in the description of railway spine. It would not have been surprising if the Judge in that case repeated the often quoted remark of Lord Campbell—"skilled witnesses come with such bias on their minds to support the cause in which they are embarked that hardly any weight should be given to their evidence."

Various remedies have been suggested for the generally admitted defects in the procedure for obtaining expert evidence. It appears to me that the suggestion most likely to prove efficacious is to give to the presiding Judge authority to call medical experts to hear the evidence of medical witnesses and to act as assessors. The law acknowledges the necessity for the assistance of nautical men to sit with the presiding Judge as assessors in nautical cases, there seems no valid reason against adopting a similar procedure in cases in which medical evidence is of importance.

"In 'The Indian Evidence Act, 1872,' "Fact," means and includes—(1) anything, state of things, or relation of things capable of being perceived by the senses ; (2) any mental condition of which any person is conscious."

SECTION 60.—" Oral evidence must, in all cases whatever, be direct ; that is to say—

If it refers to a fact which could be seen, it must be the evidence of a witness who says he saw it ; If it refers to a fact which could be heard, it must be the evidence of a witness who says he heard it ; If it refers to a fact which could be perceived by any other sense or in any other manner, it must be the evidence of a witness who says he perceived it by that sense or in that manner.

If it refers to an opinion or to the grounds on which that opinion is held, it must be the evidence of the person who holds that opinion on those grounds ; Provided that the opinions of experts expressed in any treatise commonly offered for sale, and the grounds on which such opinions are held, may be proved by the production of such treatise if the author is dead or cannot be found, or has become incapable of giving evidence, or cannot be called as a witness without an amount of delay or expense which the court regards as unreasonable :

Provided also that, if oral evidence refers to the existence or condition of any material thing other than a document, the court may, if it thinks fit, require the production of such material thing for its inspection."

SECTION 32.—" Statements, written or verbal, of relevant facts made by a person who is dead........................., are themselves relevant facts in the following cases :—

(1) When the statement is made by a person as to the cause of his death, or as to any of the circumstances of the transaction which resulted in his death, in cases in which the cause of that person's death comes into question.

Such statements are relevant whether the person who made them was or was not, at the time when they were made, under expectation of death, and whatever may be the nature of the proceeding in which the cause of his death comes into question."

The law in England with regard to dying declarations is different from that in India. In England a dying declaration is only admissible as evidence, if the person making it, believes that he is dying, and has absolutely lost all hope of recovery.

SECTION 33.—" Evidence given by a witness in a judicial proceeding, or before any person authorized by law to take it, is relevant for the purpose of proving, in a subsequent judicial proceeding, or in a later stage of the same judicial proceeding, the truth of the facts which it states, when the witness is dead or cannot be found, or is incapable of giving evidence, or is kept out of the way by the adverse party, or if his presence cannot be obtained without an amount of delay or expense which, under the circumstances of the case, the court considers unreasonable.

Provided—

That the adverse party in the first proceeding had the right and opportunity to cross-examine."

THE CODE OF CRIMINAL PROCEDURE, SECTION 509.—" The deposition of a Civil Surgeon or other medical witness, taken and attested by a Magistrate in the presence of the accused or taken on commission under Chapter XL may be given in evidence in any inquiry, trial or other proceeding under the Code of Criminal Procedure, although the deponent is not called as a witness, but the Court may, if it thinks fit, summon and examine the deponent."

SECTION 510.—" Any document purporting to be a report under the hand of any Chemical Examiner, or Assistant Chemical Examiner to Government, upon any matter or thing duly submitted to him for examination, or analysis and report, in the course of any proceeding under the Code of Criminal Procedure, may be used as evidence in any inquiry, trial, or other proceeding under the said Code."

There are two sections of the Indian Evidence Act of special medico-legal importance.

SECTION 45.—" When the Court has to form an opinion upon a point of foreign law, or science or art, or as to the identity of handwriting, the opinions upon that point of persons specially skilled in such foreign law, science or art, are relevant facts.

Such persons are called experts.

ILLUSTRATIONS.

(*a*) The question is, whether the death of *A* was caused by poison.

The opinions of experts as to the symptoms produced by the poison by which *A* is supposed to have died, are relevant.

(*b*) The question is, whether *A*, at the time of doing a certain act, was, by reason of unsoundness of mind, incapable of knowing of the nature of the act or that he was doing what was either wrong or contrary to law.

The opinions of experts upon the question whether the symptoms exhibited by *A* commonly show unsoundness of mind, and whether such unsoundness of mind usually renders persons incapable of knowing the nature of the acts which they do, or of knowing that what they do is either wrong or contrary to law, are relevant."

SECTION 46.—" Facts, not otherwise relevant, are relevant if they support or are inconsistent with the opinions of experts, when such opinions are relevant.

ILLUSTRATION.

(*a*) The question is, whether *A* was poisoned by a certain poison.

The fact that other persons, who were poisoned by that poison, exhibited certain symptoms which experts affirm or deny to be symptoms of that poison, is relevant.

As regards witnesses, Indian Evidence Act, Section 118.—" All persons shall be competent to testify unless the Court considers that they are prevented from understanding the questions put to them, or from giving rational answers to those questions, by tender years, extreme old age, disease, whether of body or mind, or any other cause of the same kind.

EXPLANATION.—A lunatic is not incompetent to testify, unless he is prevented by his lunacy from understanding the questions put to him and giving rational answers to them."

As regards the obligation to give evidence, a person who has been legally subpœnaed must obey and give evidence in any case in which he has knowledge of facts. If a witness gives evidence of facts that is to say acts as a common witness, he may be asked to give his opinion and he must not refuse. As regards appearing only as an expert, it is probable that an expert need not obey a subpœna ; under the existing system of employing experts as witnesses for a side, it is very unlikely that any steps would be taken to compel the attendance of an unwilling expert. If an expert is called by the court it would be advisable to obey and if not willing to give evidence, to make a protest before being put on oath.

A witness is not permitted to read his evidence from writings, but he may refresh his memory by referring to notes provided he first obtains the permission of the Court. " The Indian Evidence Act, Section 159.—" A witness may, while under examination, refresh his memory by referring to any writing made by himself at the time of the transaction concerning which he is questioned, or as soon afterwards that the Court considers it likely that the transaction was at that time fresh in his memory.

The witness may also refer to any writing made by any other person, and read by the witness within the time aforesaid, if when he read it he knew it to be correct.

Whenever a witness may refresh his memory by reference to any document, he may, with the permission of the court, refer to a copy of such document : Provided the Court be satisfied that there is sufficient reason for the non-production of the original.

An expert may refresh his memory by reference to professional treatises."

Section 160.—" A witness may also testify to facts mentioned in any document as is mentioned in Section one hundred and fifty-nine, although he has no specific recollection of the facts themselves, if he is sure that the facts were correctly recorded in the document. "

As to professional secrets, it has been decided that in a court of law a medical man is bound to divulge secrets which he has become acquainted with during his professional attendance ; he must answer every question which the court permits. The remark made by Lord Mansfield may be quoted : " If a medical man was voluntarily to reveal these secrets, to be sure, he would be guilty of a breach of honour and of great indiscretion ; but to give that information which by the law of the land he is bound to do, will never be imputed to him as any indiscretion whatever."

A medical man may be the recipient of confessions of guilt and of dying declarations. In both cases, his duty is to hear the statement and to record it as soon as possible in the exact words used. He should avoid putting questions except such as are required to clear up an obscure or ambiguous phrase. He should read over the statement to the person making it, get him to sign it and sign it himself. He should ascertain the mental condition of the person.

When a medical man has under his care a person in danger of death from criminal causes, or one who desires to make a confession, he should at once take steps to have information sent to the Magistrate in order that the evidence of the person may be taken. This course relieves the medical man of the duty of receiving the dying declaration or confession and should be followed when possible.

According to the procedure in courts, a witness is called by one side and is first examined by the party who calls him ; this is his examination-in-chief. He may, then, be cross-examined by the adverse party, after which he may be re-examined by the party who calls him. The examination and cross-examination must relate to relevant facts, but the cross-examination need not be confined to the facts to which the witness testified on his examination-in-chief. Leading questions or questions suggesting the answer which the questioner wishes or expects to receive, must not, if objected to by the adverse party, be asked in an examination-in-chief, or in a re-examination, except with the permission of the Court. Such questions may be asked in cross-examination. (Indian Evidence Act, Chap. X.)

A medical man should perform the duty of giving evidence with an impartial mind, free from bias. In the words of his oath, " his evidence shall be true," he " shall conceal nothing and no part of his evidence shall be false." It is his duty to state fully all the facts known to him, and if the questions put to him do not elicit every fact, he must supply the deficiency so that his statement may be complete. He should use simple words, avoiding as much as possible the employment of technical terms, where these have to be used he should endeavour to explain them. When answering questions regarding facts, he must avoid giving his opinions ; he must never dogmatically assert as facts subjects which are only matters of opinion. When giving expert evidence he may refresh his memory by reference to the works of standard authors, but the opinions which he gives must be his own, the result of his professional knowledge and experience. He must carefully guard against expressing an opinion on the general merits of the case. "When scientific men are called as witnesses, they are not entitled to give their opinion as to the merits of the case but only as to the facts proved at the trial."

In the examination of an expert witness, it is a common practice with Counsel to produce a book by a well known author and to ask the witness if he is acquainted with it and recognises it as an authority. If the answer is in the affirmative, Counsel may read an extract and ask witness if he agrees with the opinion expressed in it. The extract read, has been selected by Counsel because it supports his contention, but it does not always represent the author's views, and if the witness has any doubt on this point he should ask to see the book. In the account of the trial of a case of arsenic poisoning an instance will be found of an extract read by Counsel, which did not give the author's views. A witness who, deliberately, by study and by his own experience, has formed an opinion on a subject should not allow himself to be overawed by eminent authors. If it happens that he does not agree with them, he should say so and give his reasons for the opinion he holds.

It is not uncommon to be requested to answer yes or no to a question. If the question is one which witness considers cannot be correctly answered in this way, he should inform the court. The wording of questions is often such as to make them difficult to understand and not infrequently what Counsel intends to be one question, consists of several. Witness should not attempt to answer a question he does not understand, he may ask to have it made clear. Lawyers being unfamiliar with medical science often ask unmeaning questions. The witness should not attempt to guess at the meaning, he should state that he does not understand the questions.

If a medical man has made a complete examination of the patient or dead body, he will find no difficulty in answering questions of fact, but the answering of questions of opinion, the expert portion of his evidence, may call for a knowledge of every branch of medical science, opinions should only be given after careful consideration and should be expressed in clear, concise and well chosen words.

MEDICO-LEGAL REPORTS.

A medical man is frequently required, in the first instance, before giving evidence, to furnish a written report of the result of his examination of a case, and to give his opinion on various points connected with it. In a case of assault, for example, he is asked to examine the injured person and submit a report in the form supplied by the police. The form provides for a full description of the injuries, and for the opinion of the medical man as to their probable consequences and manner of causation. He may be required to examine and report on an alleged insane. If he makes a post-mortem examination he is required to furnish a report in the prescribed form and to give his opinion as to the cause of death.

A medico-legal report is a document of great importance; not infrequently the action of the police in a suspicious case is guided by the report of the medical man who examines the injured person or the dead body; an inquiry may be taken up or abandoned according to the opinion given in his report. It is manifest that every care should be taken in making out so important a document. It should be prepared systematically and the mixing of facts and inferences avoided. The report should be divided into two parts: the first to contain a statement of facts, the second, opinions or inferences drawn from the facts.

The drawing up of the first part will, as a rule, present no difficulty, it requires care and method, so that no fact may be omitted. The description of appearances should be full, in simple language, avoiding all technical terms as much as possible; where these have to be used, an explanation of them should be added. If the report deals with a post-mortem examination, it must be furnished on the form prescribed by Government. In the description of injuries, the size must be ascertained by measurement and expressed in inches; blood effusions, and other fluids, the contents of the stomach, etc., should be measured and the quantity given in pints and ounces.

If the body was inspected at the place where discovered, the appearances of the body and the surroundings should be entered fully in the first part of the report. Facts thus obtained are often of the greatest assistance in forming an opinion as to the nature of a case.

The second part of the report deals only with the deductions drawn from the facts. It is the expert and more important part of the report and also the more difficult.

This part should be as brief as is consistent with clearness, opinions should be expressed in the simplest words, all exaggerated expressions must be avoided, only those inferences should be drawn, which are justified by the statement of facts. In many cases, great difficulty is experienced in giving an opinion, the post-mortem appearances may be indefinite, no lesion sufficient to account for death may be found. For example, it is well-known that death may result from a blow on certain parts of the body and no sign of injury be discoverable after death. It is manifest that, in such cases, no opinion as to the cause of death is possible from an examination of the body ; and in order to come to a conclusion, the medical man must be informed of the fact that the deceased received a blow on a certain part of the body. With this information and the absence of all lesions in the body, he is justified in giving the opinion that death was due to shock or cardio-respiratory inhibition caused by the blow.

There exists in the minds of many persons, the erroneous belief that a post-mortem examination must necessarily, and in all cases, reveal the cause of death. It is not so ; a post-mortem examination generally reveals the mode of death, but often not the cause, and in a considerable number of cases, a knowledge of the circumstances attending the death is absolutely necessary to enable a medical expert to give an opinion. It may be pointed out that the diagnosis of shock as the cause of death can only be inferential. Fatal concussion of the brain from a blow cannot be diagnosed by a post-mortem examination ; it can only be inferred from the history and the absence of lesions.

When the medical man makes use of the history of the case, supplied to him by the police or by others, in arriving at an opinion as to the cause of death, he must be careful to mention it in wording his opinion, thus: "From the history of the case and the post-mortem appearances I am of opinion deceased died from shock caused by a blow." It is advisable that the history of the case should be obtained in writing. If a statement is made to the medical man, he should reduce it to writing and enter it in the first part of the report, giving name of his informant.

In many cases an opinion as to the cause of death can only be given after the result of the chemical analysis of the viscera is known. The Medical witness states in his report that he defers giving an opinion until hearing the result of the chemical analysis.

CHAPTER I.

DEATH.

In most persons death takes place by the gradual failure of the respiration and circulation ; in nearly all, the heart continues to beat for a few seconds, or even a few minutes, after breathing has finally stopped, occasionally respiration and circulation cease simultaneously, and in very rare cases, the heart is said to stop before the breathing. When respiration ceases before the circulation, death is said to occur by asphyxia ; apnœa would be a more correct term, but this word is now used to denote cessation of the respiratory movements due to excess of oxygen in the blood. The phenomena of asphyxia and the post-mortem appearances of this mode of death will be described in connection with hanging, drowning and other mechanically produced deaths by asphyxia.

Simultaneous stoppage of respiration and circulation is known as cardio-respiratory inhibition, shock or syncope. It may be caused by violence or by mental emotion. It has occurred from a blow on the abdomen, chest, larynx, nose and other parts of the body, though no mark of injury could be found. It has been produced by the passage of a sound into the uterus, a catheter into the bladder, a probe into the nose. Under some circumstances a slight peripheral irritation has the power of inhibiting the circulation and respiration, the effect is immediate, the cessation may be temporary, the functions being resumed after a short interval, or it may be permanent. Mental emotion has produced the same effect, people have died of fright.

The post-mortem appearances of cardio-respiratory inhibition, are not characteristic; the heart may be full or empty, the blood has generally a well aerated appearance, there is no cyanosis. These signs are not sufficient to enable a diagonis to be made ; the history of the case and the absence of lesions may enable the medical jurist to infer the cause of death.

The Signs of Death.—In all countries in which burial is the usual method for the disposal of the dead, there is a widely prevalent idea that burying alive is not only possible but that it occurs, especially during the prevalence of epidemics. With some persons, the danger of premature burial is so real that they have given instructions to have their bodies examined by a medical man and a blood vessel opened or some other test of the reality of death applied before the coffin is closed. There are no grounds for this fear. It is one of those beliefs which originated, probably, in the times when burying alive was a recognised punishment, and, in the present day is kept up by sensational reports of exhumations where the position of the corpse has been found altered and the inference drawn that the individual must have been alive when put into the coffin, whereas the alteration is the result of putrefaction.

Death causes such changes in the appearance of the body that doubt as to the reality of the death is seldom experienced, but in rare cases a corpse retains, for a time, a life-like appearance which causes anxiety to the friends and a feeling that possibly the deceased is not dead; and in very rare cases a living person has fallen into a condition simulating death. In the popular mind cataleptic states are believed to closely resemble death, but no medical man could fail, by careful examination, to distinguish one from the other. A medical man may meet with a case where for a short time he is unable to determine with certainty whether the individual is dead or in a condition of suspended animation. A person in a state of cardio-respiratory inhibition gives no sign of life, breathing and heart's action are absent, but the condition can only last a very few minutes, either the actions of the heart and lungs return or they have finally ceased and the man is dead. In cases of this kind a medical man should assume that the person is living and by artificial respiration and stimulation endeavour to restore animation, desisting only when he is satisfied that the heart and lungs have stopped finally.

The most obvious signs of death are the arrest of respiration and circulation, if their cessation is permanent, the individual is dead; the difficulty lies in determining their absence and various tests have been suggested.

Cessation of circulation may be ascertained by careful auscultation and palpation over the cardiac region, carried out deliberately in a quiet room. The examination should be repeated at short intervals, the ear being applied to the stethoscope for a minute or longer on each occasion. The application of a ligature to a finger is another means of determining the absence of circulation, if it is going on, the finger will swell beyond the ligature, owing to the accumulation of blood in the part. Cessation of respiration may be determined by the stethoscope which should be placed over different parts of the chest. A bright mirror becomes dimmed by the moisture of the breath, and a feather or other light object is moved when held close to the mouth, if respiration is taking place.

All these tests fail in cardio-respiratory inhibition which, as already mentioned, cannot continue for more than a few minutes. In the case of Colonel Townshend, which was probably of this nature, respiration and circulation are said to have been absent about half an hour, but it does not appear that the time was measured with a watch. Cases have been reported of resuscitation after submersion in water for half an hour or even one hour, it is difficult to believe that life would continue for so long after the cessation of respiration, it is possible that in these cases the face was not completely covered by the water.

There are other signs which assist in determining whether an individual is dead or not. At the moment of death, the muscles relax and lose their tonicity, the jaw falls, the eyes are half open, the skin is pale and less wrinkled, so that in the case of an elderly person, the features may have a more youthful appearance than in life. All movement and sensibility are lost, the skin feels cold and the temperature of the body falls. The eyes lose their lustre, the tension of the eyeball is lost, the cornea becomes flattened and retains the dent made by pressure with the finger nail. The pupils do not respond to light, but are still acted on by atropine for some hours after death. At the time of death, the pupils are generally in a condition of marked dilatation, subsequently by the relaxation of the iris muscle they diminish and, by the time a post-mortem is usually held, are of moderate size.

All these minor signs are subject to exceptions, and consequently do not possess an absolute value, still they should be looked for in doubtful cases.

During life there is a constant production of heat within the body, the temperature of which is maintained in the health at a constant height, whatever may be the temperature of the surrounding air. After death, the generation of heat ceases, and the temperature of the body becomes the same as that of its surroundings. Generally speaking cooling of the body takes place, but in a very hot climate, it is quite possible that the temperature of the air may be higher than the normal temperature of the body.

The time occupied in the cooling of the body is determined by certain factors, some of which belong to the body, others to the surroundings. Considering the former first, the temperature at death may be above or below the normal point, if above, cooling will take longer. In fevers, heat stroke and other diseases the temperature may be very high at the time of death ; in a case of heatstroke examined in June, after the setting in of the rains, the temperature within the abdomen was 105·4° Fah. thirteen hours after death, which occurred in the evening. The body clothed in a cotton shirt and trousers, lay in the morgue all night, the examination was made at 8-30 A. M. The daily weather report gave the maximum temperature 93·9° Fah. the minimum 76·9° Fah. and at 8 A. M. 84° Fah. in the shade on that day.

After death from certain diseases, there may be a post-mortem rise of temperature, said to be due to unusual chemical action in the muscles. In most individuals dying from disease, the temperature is sub-normal before death. In the bodies of those who have died suddenly from shock, suffocation or apoplexy cooling is less rapid than in death from other causes. Fat bodies cool more slowly than thin, the bodies of the very old and of the very young cool more rapidly than those of adults.

The conditions external to the body, which modify the rate of the loss of heat are the nature, temperature and condition of the medium in which the body lies. A body submerged in water cools more rapidly than in air of the same temperature, because water is a better conductor of heat. The greater the difference between the temperature of the body and that of the medium in which it lies the greater the rate of loss of heat. In England, the average rate of cooling for the first three hours is given by Taylor, as 4° Fah. per hour; in the next six hours the rate is three degrees per hour ; and, at a later period, the loss falls to about one degree per hour. It is necessary to bear in mind that when the temperature of the medium is high, though the rate of loss of heat from the body is low, the amount which it has to part with to produce an equilibrium is small. I am not aware of any precise observations on the subject in India, from my personal experience I have come to the conclusion that the body is cold in India in less time than in England.

A naked body will cool more rapidly than one covered, and one lying in the open or in a well ventilated room than one in a closed space in which there is no current of air.

European observers fix the time occupied in the cooling of the body at fifteen to twenty hours, on an average.

The time that a body takes to cool may be an important question in a Criminal Case ; the medical jurist can only give a guarded opinion, after taking into consideration the condition of the body, its surroundings and the other points to which attention has been directed.

By death we mean the death of the body as a whole, somatic or systemic death ; when it has occurred the body is not devoid of vitality, there remains, for a varying time, the vitality of the individual tissues. We are able to judge of the persistence of the tissue vitality only in the contractile structures, in which it is evidenced by their response to stimuli, chemical, mechanical and electrical. After a time the contractility is lost, the muscle passes into a condition of rigidity and no longer give any sign of life. The loss of muscular irritability occurs gradually, in different muscles and in different parts of the same muscle. The duration of irritability varies greatly, Taylor gives from a few minutes to twenty-four hours. Mackenzie, in observations on the bodies of individuals who had died of disease, found in the first series, the average duration was 1 hour 51 minutes, the shortest 30 minutes, the longest 4 hours 30 minutes ; in his second series, the average was 1 hour 42 minutes, the shortest 1 hour, the longest 3 hours 30 minutes. It may be observed that the bodies were, probably all, in a more or less marked state of emaciation.

In some cases, notably in deaths from cholera, muscular irritability is unusually marked, and may cause movements of the fingers and toes for several hours. In a case of cholera, the great toes and thumbs exhibited a marked regular movement, and the other fingers and toes also, but of a less extensive character, without the application of a stimulus.

The tissues lose their firmness and elasticity very soon after death; the buttocks and other parts on which the body rests, are flattened and do not resume their original shape when the pressure is removed.

POST-MORTEM STAINS, CADAVERIC LIVIDITIES, HYPOSTASES, or SUGILLATIONS are produced by the accumulation of blood in the veins and capillaries of the dependent portions of organs and parts of the body.

After death, the body becomes subject to the laws that govern inanimate matter, and the blood and other fluids gravitate into the dependent parts.

In the skin post-mortem stains make their appearance generally within twelve hours of death, sometimes much earlier; in the body of a European, who died of opium poisoning, they were extensive and well developed when inspection took place an hour after death. They may appear earlier, and similar discolorations may occur during life; in cases where a person lies for a long time in the recumbent position and the heart fails slowly, blood will accumulate in the dependent and distant parts of the body, the skin may present patches of livid red for some days before death; hypostasis of the lungs is one of the dangers, the physician endeavours to ward off, in cases of adynamic fevers and in the aged.

When the conditions mentioned have existed during life without producing patches of discoloration, the development of post-mortem stains, already begun during life, will take place very soon after death.

In MacKenzie's observations, the earliest appearance of death stains was 1 hour 38 minutes, the latest 31 hours 30 minutes.

The usual posture for dead bodies is on the back, consequently death stains are found in the skin of the posterior part of the scalp, lobes of the ears, neck and of the back, except at the points which bear the weight of the body; in these places the veins and capillaries are compressed, the blood is driven out of them, the skin remains pale.

The formation of death stains continues until the blood has coagulated, which in the small vessels does not occur for many hours. The coagulation of the blood within the body after death takes place slowly, begins in the heart and large vessels, and spreads gradually to the smaller vessels. The process is rendered slower by certain conditions, the commonest of which is the presence of carbon-dioxide in excess. For this reason in death by asphyxia, the blood remains fluid longer than usual, and post-mortem stains are well marked. While the blood is fluid, death stains can be removed by altering the position of the body, also by pressure, but when coagulation has taken place they are permanent and cannot be displaced. Generally, post-mortem stains will completely disappear from a part, if the position of the body is altered within four hours of their formation, later than this they may become less evident, but will not be entirely removed.

In the skin, post-mortem stains are patches of red discoloration, irregular in shape, borders well-defined, surface not raised, colour uniform throughout. The colour of the patch varies according to the condition of the blood. In cases of asphyxia it is dull red, in death from carbon-monoxide poisoning bright or cherry red. When first formed the stains are small, they gradually enlarge, adjoining patches coalesce and large areas are produced. In the bodies of the drowned patches of bright red colour are often seen, they are produced by the hæmoglobin, set free from the red cells, soaking into the tissues and becoming oxyhæmoglobin.

Post-mortem stains may be mistaken for bruises; the mistake is not one likely to be made by a medical man, but laymen, even police officers of experience, sometimes report the presence of bruises on a body, which, on examination, are found to be death stains. The differences are marked and easily recognised; a post-mortem stain is of a uniform colour, not elevated, surface shows no sign of injury, margins well defined, appears, as a rule, some hours after death in a dependent part not subjected to pressure.

Bruises made during life are discolorations caused by extravasation of blood into the tissues from vessels ruptured by violence, consequently the surface generally exhibits some trace of the violence but this may be absent, the bruise is elevated, the margin ill defined, the colour deepest in the centre, fades gradually into the surrounding parts ; if the bruise is of some duration, the blood will exhibit changes of colour.

If doubt remains, and in all cases where the statement has been made that the discolorations found on a corpse are bruises, an incision should be made through the suspected patch ; in a death stain there is no extravasation of blood, the incision is followed, at most, by a few isolated drops of blood from divided veins ; incision of a bruise reveals the presence of blood, fluid or clotted, in the skin and tissues.

The post-mortem stains most likely to be mistaken for bruises are those of a striped form, such as result from the body lying on a ridged surface ; when the back is inspected it is found to be marked by transverse bands of red and white alternately, the red stripes have been mistaken for marks of flogging.

A very slight amount of pressure suffices, to prevent the formation of a death stain, a tight collar or tie round the neck will cause a white mark which may give rise to suspicion of strangulation.

Post-mortem stains occur in all cases, they are best marked and most extensive in bodies full of blood, they are found even in death from hæmorrhage, and in cases of profound anæmia but less extensive, less marked and of lighter colour.

Internal Post-Mortem Stains or Hypostases.—All organs except the heart show post-mortem hypostases, due to the gravitation of the blood into the vessels of the dependent portions. The appearances produced may be mistaken for the effects of vital congestions, the usual position of a dead body is on the back, consequently gravitation takes place to the posterior portions of the organs, and in those which are naturally rich in blood, a condition is produced which has been frequently mistaken for vital congestion. The back of the scalp, the posterior portion of the membranes and substance of the brain, the back of the lungs, liver and under surface of the kidneys, and the dependent parts of the coils of intestine and stomach will be found filled with blood which has gravitated into them. The diagnosis from vital congestion is made by observing the position of the engorged parts ; in the lungs, in which the appearance is generally very marked, by noting the gradual transition from the deep red of the dependent portions to the light grey of the upper parts. As already mentioned, hypostasis of the back of the lungs occurs in cases of slow failure of the circulation, it cannot be distinguished from the engorgement due to gravitation after death.

In the intestines, the diagnosis from vital congestion is made by the engorgement occurring in patches, corresponding to the dependent portions of the coils.

In the spinal canal and in the spinal cord an appearance, which must be distinguished from vital congestion, is caused by post-mortem gravitation.

RIGOR MORTIS, CADAVERIC OR DEATH RIGIDITY.—Muscular irritability persists for some time after somatic death; it is lost gradually and disappears earlier from some muscles than from others, and from some fibres of the same muscle. Its loss is followed by the occurrence of a condition of hardness and rigidity, called rigor mortis. When fully developed, rigor mortis changes the hitherto limp body into a stiff, rigid, jointless structure, the muscles are harder, thicker and shorter. The entrance of rigor mortis is accompanied by contraction, but its energy is not great, and the opposing muscles prevent any movement taking place, the position assumed by the limbs after death if left to themselves is one of semiflexion and the occurrence of rigor mortis does not alter it.

Rigor mortis is believed to be due to the coagulation of the muscle plasma, the setting free of myosin from myosinogen. The process is divisible into two stages; during the first, the muscle is still irritable and the passage of arterial blood through its vessels completely removes all sign of coagulation, the effect is only temporary; after a time coagulation takes place, irritability is permanently lost, the muscle no longer shows any sign of life.

In the dead body, the muscles pass into the condition of rigor mortis in a definite order; first those of the jaw and face, then those of the neck, trunk and limbs; as regards the latter, the legs generally stiffen before the arms, according to my observations.

The time of onset of rigor mortis varies greatly, it is governed by external circumstances and, mainly, by the condition of the muscles. Warmth hastens, cold retards the onset. The principal factor is the condition of the muscles as regards vitality; in vigorous, unexhausted muscles the onset of rigor mortis is delayed, but when it comes on, it is pronounced and of long duration. In the opposite condition of exhaustion and low vitality, such as in hunted animals and in persons who die of wasting diseases, the onset is very early, the hardness and stiffness slight, and the duration short.

In England rigor mortis generally appears about six hours after death. In India, Mackenzie's observations on the bodies of persons who died of disease, give an average of 1 hour 56 minutes in his first series, and of 1 hour 10 minutes in his second series, between death and the onset of rigidity. In some cases, the onset occurs immediately after death, and the whole body may be stiff within a few minutes; Assistant Surgeon S. S. Mitra found the body of a woman, who died of diarrhœa, completely rigid fifteen minutes after death.

The average time of onset in healthy bodies in India may be given as about four hours after death, and the duration about 24 hours; but there are many exceptions. Bodies are met with in which rigor mortis has passed off much sooner than the condition of the muscles, and the circumstances of the death would lead one to expect; on the other hand, emaciated bodies may remain rigid for an unusual time. Apparently there are factors concerned in the production and continuance of rigor mortis, which at present are unknown.

Mackenzie's first series of thirty-six bodies gives an average duration of 19 hours 12 minutes, the longest 40 hours, the shortest 3 hours.

Casper records a case of nine days duration; and in a corpse exhumed eight weeks after death there was marked rigidity of the legs, the lower jaw was also rigid. Dr. F. A. Harris, who records this case, states that the absence of rigidity in the arms may have been due to the forcible flexing of the joints in dressing the corpse shortly before burial.

In the bodies of new born children rigor mortis occurs early, and has a short duration; it is said not to occur in the fœtus before the seventh month.

The disappearance of rigor mortis follows in the order of its entrance, but according to my observation, the lower jaw, which is the earliest affected, as a rule, is still rigid after the neck, trunk and limbs have completely relaxed.

The muscles from which rigor mortis has disappeared, are soft and flabby, give no response to stimulation, and exhibit no sign of vitality.

During the existence of rigor mortis if a limb be forcibly bent, the rigidity is destroyed and does not recur.

In India, signs of putrefaction generally appear before rigor mortis has passed off, and not infrequently the process is well advanced in a still rigid body. Rigor Mortis occurs in the involuntary muscles and in the heart earlier than in the skeletal muscles. In the heart, rigidity is attended by contraction which affects the capacity and the contents of the ventricles, especially of the left. Strassmann's experiments have been referred to in describing death by asphyxia; he is of opinion that the heart always stops in diastole with both ventricles full of blood, and that, subsequently, the occurrence of rigor mortis causes contraction, which in the case of the left ventricle, owing to its great muscularity, empties it completely or of the greater part of its contents. His experiments have been repeated by other observers, some of whom obtained different results. I may add that in the few cases in which I examined the heart before the onset of rigor mortis, both ventricles were found full of blood.

When the heart is examined, during rigor mortis, the walls, particularly, of the left ventricle are thickened and the condition may be mistaken for hypertrophy. After rigidity, the relaxed state of the cavities may be taken for dilatation.

Instantaneous or Cadaveric Spasm.—Occasionally the body becomes fixed in the attitude occupied at the moment of death. This has been observed in sudden death under various circumstances, generally in death from violence; in the Franco-German war several instances were recorded. A soldier was found sitting on the bank of a stream, his head had been carried away by a cannon ball, leaving the jaw hanging down, his right hand grasped a tin of water, his right arm was bent and directed towards the mouth in the attitude of drinking.

At Balaklava, Captain Nolan riding in advance of the Cavalry was struck by a shell which tore open his chest. He retained his seat in the saddle and the arm which he was waving in the air remained uplifted. His horse wheeled round and passed through the ranks before Captain Nolan fell out of the saddle.

In the Vierteljahrschrift für gericht. Med. 1889, Seydel has written an article on the subject and has given several examples, in death under different circumstances.

The subject is of great medico-legal importance; in many recorded cases of suicide the weapon has been found grasped by the hand, affording evidence of the greatest value, for the hand of a dead person cannot be made to grasp, even though the weapon was placed in it immediately after death, and the fingers bandaged so as to retain them in position until the onset of rigor mortis.

Instantaneous spasm is very rare, it has been observed in cases of hanging, drowning, poisoning, cut throat and other wounds, gunshot wounds and injuries of various kinds. In the very large number of sudden deaths which I have examined, only in one case of suicidal cut throat was there any appearance suggesting instantaneous spasm. That case may be briefly described:—About 5 A.M. a woman knocked at the door of a hut and called to the woman residing there. She got no reply but heard a sound of groaning. She told a man and he burst open the door which was fastened from within. On the bed lay the body of the woman with her throat cut, and on the floor lying on his face, the body of a man. The Police were sent for, and on arrival turned over the man's body, they saw his throat was cut and, in his right hand an open knife, which, the Inspector stated, was tightly grasped by the four fingers and thumb. The knife was not disturbed. The body was placed on a cot and taken to the morgue where I examined it at 10 A.M., probably five hours after death. Rigor mortis was general and well marked. The arms were bent and lay across the chest. The fingers of the right hand were flexed to the extent usually seen in a corpse. The tip of the thumb rested on the index finger. The third, fourth and fifth fingers were more flexed than the index, and their tips were close to the palm. The knife lay between the palm and the thumb and fingers, it was not grasped. It appeared to be retained by the position of the hand and by the dried blood, by which it was struck to the first phalanx of index finger and palm. The whole of the hand, back and front, and the knife, were covered with dried blood. The fingers of the left hand were in very much the same position as those of the right, the thumb rested between the index and middle fingers. It cannot be said that at the time of my examination the knife was grasped. It is possible that as described by the Inspector who saw the body within an hour of death—there was a Police Station close by—the knife was tightly grasped and that subsequently relaxation took place before rigor mortis set in.

There is another possibility, the Inspector seeing the knife in the hand covered with blood may not have examined very closely, but assumed that it was an instance of a condition of which every policeman has heard, the grasping of a weapon by a suicide.

At present there is no explanation of instantaneous spasm, it appears not to be a form of rigor mortis, if it was we should probably meet with it more often. Falk and Schroff, junior, seem to have produced a condition of instantaneous rigidity by lesions of the upper part of the spinal cord.

CHAPTER II.

PUTREFACTION.

Putrefaction is the process by which dead organic matter, animal or vegetable, is broken up, its complex molecules reduced to simpler compounds, and finally to the elements and simple inorganic combinations.

The essential agents in the process are micro-organisms, called saprophytes, of which the number of different kinds is enormous; each stage of the process of decomposition is effected by special varieties of saprophytes, and the products of their activity differ from those formed in other stages. In general terms, it may be said, that the beginning of putrefaction is effected by micro-organisms of the aerobic type, that is, which require a supply of air for their development, and the products of their activity are mostly carbonic acid. They are quickly followed by micro-organisms which are able to live either with or without a supply of oxygen from the air. These produce in the tissues carbonic acid and compounds of hydrogen with sulphur, phosphorus and carbon, and other gases. Then come the anaerobic type of micro-organisms by which the decomposition of the tissues is principally effected, their activity results in the production of compounds of nitrogen, ammonias of different kinds, also hydrogen, carbonic oxide and other gases.

The above description applies to putrefaction in air and is only correct in a general sense, the different types of micro-organisms, aerobic, anaerobic and mixed, are present and active within the body at the same time; those of the different types predominating at different times.

The destruction of the body is assisted by the different forms of insect life, which infest it when putrefaction occurs in the air or in the soil. Flies lay their ova on the dead, mostly at the orifices, about the eyes, nose, mouth, about the genitals and anus, if these parts are uncovered. Maggots may appear very early; I have seen them twelve hours after death. It is probable that in these cases the ova were deposited before death.

Ants are also very destructive, their bites when on dependent parts, often cause considerable oozing of blood which may give rise to the suspicion that vital wounds are present.

Ants appear to attack the ano-genital region and the face in preference to other parts.

Rats do much damage to a dead body, large portions of the flesh may be gnawed away in a few hours. Bodies found in the streets are often mutilated by dogs, and, in the outlying parts of the town of Calcutta, by jackals.

In the tanks and rivers dead bodies are often greatly mutilated by fishes, turtles, prawns, etc. The anus is the part usually first attacked.

Putrefaction or the resolution of the body into its inorganic constituents is effected by micro-organisms, whose activity is promoted by certain conditions, and retarded or prevented by others.

The conditions which influence putrefaction may be divided into those of the surroundings, and those belonging to the body.

The surroundings or external conditions, which promote the activity of micro-organisms and therefore of putrefaction, are heat, moisture and air.

A temperature of between 90° and 100° Fah. is most favourable, especially when combined with an abundant supply of moist air. These conditions are present in Lower Bengal and other parts of India nearly throughout the year in perfection, and, in consequence, putrefaction occurs above ground at a rate, which is hardly conceivable by an observer whose experience is of cold and temperate climates.

The external conditions, which retard putrefaction are low temperature, below 32° Fah., the activity of micro-organisms is arrested. They are not killed and if the temperature be raised, they again become active. A temperature of 212° Fah. stops putrefaction, and if continued for more than a few minutes kills the micro-organisms.

Absence of moisture retards putrefaction, and although the body contains in its tissues sufficient fluid for complete putrefaction, if the conditions favour rapid evaporation desiccation occurs and the body mummifies.

Complete submersion retards putrefaction by interfering with the access of air.

Inclosing the body in an air-tight coffin, and burial especially if deep, and in a dense clay soil retard putrefaction, the air within the coffin is quickly used up and the activity of the aerobic germs ceases, but the process goes on by the agency of the anaerobic micro-organisms which obtain the oxygen they require from the tissues.

CONDITIONS OF THE BODY, WHICH MODIFY THE PROGRESS OF PUTREFACTION.

The bodies of young children decompose more rapidly, than those of adults ; fat bodies quicker than thin. The lean dried up bodies of the aged putrefy slowly.

The cause of death has great influence on the rate of putrefaction ; in death from septic diseases, fevers, dysentery, decomposition is extremely rapid. In cases of extensive injury and much laceration of the surface putrefaction occurs rapidly, the micro-organisms have access to the tissues through the wounds.

Putrefaction is said to be retarded in death from alcohol, carbolic acid, arsenic and other poisons. I have not noticed any difference ; I have referred to the question in dealing with arsenic, I may here point out that according to Vaughan, the presence of arsenic does not interrupt anaerobic putrefaction.

SIGNS OF PUTREFACTION.

Throughout life, from a few hours after birth, the alimentary canal from the mouth to the anus swarms with micro-organisms belonging to the class of saprophytes. They assist in various processes connected with digestion, and their presence must be looked on as normal, and probably beneficial to a greater extent than we are at present aware.

Soon after death, in some cases probably even before, the epithelial lining of the alimentary canal loses its vitality, and the saprophytes, which are unable to act on living tissues, begin to destroy the dead cells. The process goes on and is attended by the evolution of gases which distend the intestines. From the epithelial lining, the saprophytes pass into the walls of the intestine and make their way through the dead tissues into the blood vessels. In the blood they find a material extremely favourable to their development, they multiply with great rapidity, and within a short time, if conditions are favourable, the blood is in a putrid condition. The development of gases in the intestines causes swelling of the abdomen, and the tension produced, pushes up the diaphragm, empties the stomach driving its contents through the œsophagus to the mouth, and causes protrusion of the rectum, and of the uterus. The putrefaction of the blood and the pressure of the resulting gases, assisted by the tension in the abdomen, drives the blood into the peripheral vessels and causes what is known as the post-mortem circulation. If there are wounds, blood and gas exude from them, a phenomenon which in the middle ages was thought to occur only when the murderer stood in front of the body of his victim.

The decomposition of the blood sets free the colouring matter from the red cells ; it stains the walls of the vessels and passes into the tissues which it also colours. The course of the veins on the surface of the body is indicated by red streaks, later on the colour becomes more diffused and it is destroyed after a time.

The cuticle, under the action of micro-organisms, becomes softened, raised, separated from the cutis by accumulations of gas and sanious fluid. Large areas are denuded, and in some cases the whole of the cuticle is removed, completely changing the appearance of the body. I have examined the body of a Negro, which without the history and the woolly hair, would easily have passed for that of a European. The hair falls out, the nails loosen, and with the skin of the hands and feet may be pulled off like a glove.

The accumulation of gas in the tissues causes great swelling of the abdomen. As the putrefaction extends, the whole of the body becomes distended enormously, the features are swollen beyond recognition, the eyeballs softened and protruded, gases bubble from the orbits, nose and mouth. The lips are swollen and everted, the tongue protrudes, the mouth is often filled with contents of the stomach. If there are wounds, or if punctures be made in the swollen tissues, gases escape. When the abdomen is opened gas may escape with a loud report.

As the process of putrefaction advances, the tissues of the abdominal wall become softened and burst from the pressure of the contained gases. The intestines and stomach burst. The thorax may burst. In children and young persons the bones of of. the head are separated and loosened by the pressure of the gases from the putrid brain.

The skin of the distended limbs gives way, the tissues are rapidly softened, all the soft parts are, after a time, reduced to a thick, semi-fluid, black mass. The cartilages and ligaments are softened, the bones separate ; finally, after many years, the bones are destroyed and all trace of the body has disappeared.

In this sketch of the putrefactive process, no mention has been made of the destruction caused by maggots. In all cases of putrefaction in air and in most cases of burial, unless special precautions were taken to prevent the access of flies, maggots appear, and in a short time the body may be covered with them. The ova are mostly deposited in the orifices, and the maggots feed on the mucous membrane, pass into the interior of the body and take a considerable part in the destruction of the soft parts.

During putrefaction, especially in the early stages, certain appearances are produced, which as they are developed in a certain order and time, are of value in arriving at an opinion regarding the time that has elapsed since death. It is necessary to point out that putrefaction, in India, exhibits very great variation in the rate of progress and in the appearances produced, so that an opinion regarding the time of death to be of value must be based on the full consideration of all the circumstances, too much reliance can easily be placed on the presence of one or two phenomena. Moreover, the signs, which are about to be described, do not always appear in the order usually followed, and further, may not occur at all, or only in a fleeting form which easily escapes notice.

About twenty-four hours after death and generally while rigor mortis is still well marked, a green discoloration appears in the abdominal walls, above the groins extending towards the umbilicus. In some cases it appears in the flanks, or on the chest, or in other parts. It may spread over the whole of the abdomen and chest. In cases of rapid putrefaction, it disappears soon and may not occur at all. Its production depends on the composition of the gases evolved.

In Mackenzie's first series of observations, the earliest appearance of green discoloration occurred 7 hours 10 minutes after death, the latest 41 hours 30 minutes, the average period 26 hours 4 minutes. In his second series, the earliest period was 16 hours 10 minutes, the latest 47 hours, the average 24 hours 16 minutes. Mackenzie made observations on 46 bodies, in 5 green discoloration was not seen.

About the time when green discoloration is observed, an odour of putrescence is perceptible, the eyeball is soft, the cornea milky, the conjunctiva soft and easily rubbed off. The abdomen is distended, blood stained froth and fluid exude from the mouth and nostrils. The contents of the stomach and lower bowel may be expelled.

Mackenzie found, in his first series, distention of the abdomen on an average 18 hours 17 minutes after death, the earliest was 5 hours 50 minutes, the latest 34 hours 30 minutes.

The blood putrifies early, the colouring matter is set free and stains the walls of the vessels and adjoining tissues. The course of the veins is marked by red lines, which are most prominent in dependent situations, but are also seen on the front of the abdomen and chest.

Softening and detachment of the cuticle and the formation of blebs occur about 24 hours after death. In some cases earlier. In a death from fever, in the month of January, about the coldest season in Calcutta, the cuticle of the abdomen was raised into blebs, 13 hours after death. There was marked distention of the abdomen, the blood was putrid and the internal organs generally had begun to soften, rigor mortis was well marked.

In Mackenzie's first series, the average period of the appearance of vesications or blebs on the surface of the body was 49 hours 34 minutes, the latest 72 hours, the earliest 35 hours. In his second series, the shortest period was 23 hours 30 minutes, the longest 87 hours 30 minutes, the average, 59 hours 8 minutes. When the cuticle is softening and becoming detached, the hair and nails are loosening and soon fall off. Frequently, especially in the drowned, the nails and cuticle of the hands and feet come off in a glovelike mass. Gases accumulate in all the tissues and parts of the body, the tension within the abdomen causes protrusion of the rectum and large intestine, and of the uterus. The arms, distended by gases, are slightly flexed and extended almost at right angles from the body; the legs also are bent and separated. The eyeballs collapse, and are protruded by the gases within the orbits. The features are unrecognisable, the face is of a red colour, especially if there was much blood in the tissues. The green discoloration disappears and gives place to a general red mottled colour, due to the staining of the tissues by the hæmoglobin. The above appearances may be produced in from thirty to forty hours after death according to the condition of the body and the surrounding circumstances.

Mackenzie found the earliest appearance of maggots was 24 hours 18 minutes, the latest 76 hours, the average 39 hours 43 minutes.

PUTREFACTION OF THE INTERNAL ORGANS.

About the period of the appearance of green discoloration of the surface of the abdomen, the mucous membrane of the trachea becomes red from staining by hæmoglobin. At the same time, or a little later, patches of staining are found at the dependent parts of the stomach ; the mucous membrane is softened, separated from the sub-mucous coat by putrefactive gases. In many cases, particularly when the stomach contains food, within 24 hours of death, the mucous membrane of the dependent portion may be completely softened, exposing the sub-mucous coat, which may undergo the same change. The whole thickness of the wall of the stomach may be involved, perforation may occur. The edges of the perforation are soft, thin, friable, devoid of any sign of inflammation ; they may be stained red by hæmoglobin but are generally pale.

There has been considerable discussion regarding the cause of the softening. Some have held that it is due to the action of gastric juice, poured out during life on the walls of the stomach after death. Others believe that it is due to the solvent action of acids, principally lactic acid, developed in the food by fermentation after death. The more probable view is that it is a putrefactive change due to the action of micro-organisms, possibly aided by one or both of the causes previously mentioned.

Softening does not occur in every stomach, in many, even in advanced putrefaction, the walls are intact, swollen and distorted by the presence of blebs of putrefactive gases.

I have observed softening mostly in debilitated bodies, cases in which the existence of chronic dyspepsia might be inferred with confidence, and in stomachs containing food.

Putrefactive changes in the intestines are similar to those in the stomach, but softening seldom extends beyond the mucous membrane until putrefaction is far advanced. The spleen putrefies rapidly, especially when diseased. Putrefaction of the blood in the vessels of the liver occurs very early, but the liver cells exhibit considerable resistance, and can be distinguished until late in the process ; the appearance of the kidneys alters very early and the condition of the organ cannot be recognised, but destruction and disintegration occur late.

The brain softens early ; I have frequently found it, in cases of drowning, in a liquid condition thirty-six hours after death.

The heart muscle is resistant and the condition of the fibres can be seen when putrefaction is far advanced. The blood in the cavities putrefies early and stains the endocardium. The colour disappears after a time.

The aorta and great vessels are very resistant, they are stained by hæmoglobin, the colour disappears in advanced putrefaction.

In my experience, the lungs, if congested at the time of death, putrefy rapidly, the tissue softens, becomes friable, the blood and fluids transude and collect in the pleural cavities.

The œsophagus, bladder, diaphragm and pancreas are very resistant to putrefaction, but of all organs the uterus appears to be most resistant, its condition can be distinguished when the soft structures generally, are no longer recognisable and almost completely destroyed.

In the putrefying body, fluids transude from the organs and collect in the spaces and tissues of the dependent parts. The transudation of fluid from the stomach occurs early, from the intestines later ; the lungs have been referred to previously.

It has been suggested that if the time the deceased took his last meal be known, the condition of the food in the stomach will assist in determining the hour of death. I have made a number of observations on this point and have come to the conclusion that among natives of this part of India, who eat, principally, rice, dâl and vegetables, the food remains in the stomach for many hours, a much longer period than is believed to be required for the digestion of the food of Europeans. I quote some instances :—A little boy aged about 8 years, very healthy appearance, was accidentally drowned at 5 P.M. From inquiry I learnt that he had taken his food between 10 and 11 A.M., more than 6 hours before death. The food in his stomach, consisting of rice, dâl and green vegetables, appeared quite unaltered, the rice grains were separate, the markings on them quite distinct.

Another case, a young man quarrelled with neighbours between 4 and 5 P.M., he was roughly handled, bruised about the neck and face, and apparently very much upset mentally by the occurrence. He went to his house, laid down on his bed, would not speak and refused to take his evening meal. During the night, the other inmates of the room heard him groaning and finding he was ill, sent for medical aid. He died without having been treated at 7 A. M., about 14 or 15 hours after the quarrel. On post-mortem examination, the stomach contained a large quantity of food, mostly rice, some dâl and meat, and also a lump of opium. The grains of rice were unaltered, the meat fibres plainly visible. In the upper part of the jejunum, there was a mass of food, soft and dry ; it consisted of rice, the grains mostly broken, and fragments of meat. On chemical analysis, opium was found in the stomach, liver and kidney, but not in the food in the jejunum. Evidently the opium was taken after portion of the food had passed into the jejunum. The friends of the deceased stated that they had sacrificed a goat in the morning, and they and the deceased had eaten the flesh, at their morning meal, at 11 A.M.

One other case will be quoted, a strong Mahomedan lascar was accidently thrown into a dry dock, he sustained a fracture of the skull, and compression of the brain by an extra dural clot. The symptoms of compression disappeared after trephining and removal of the clot, but the man died about 12 hours after the injury. In his stomach there was a large quantity of undigested rice, dâl and vegetables, which he had eaten the night before about 10 hours before the accident.

Many other cases giving similar results could be mentioned, also the experience of emptying the stomach in cases of poisoning. These observations are of medico-legal importance, they show that the presence of food in the stomach does not justify the opinion that the deceased died within six hours of taking his last meal. The food eaten by the people of Lower Bengal, may remain many hours in the stomach of healthy individuals without undergoing visible alteration. It is probable that these observations hold good for the people of other parts of India.

In addition to the gases previously mentioned, the action of saprophytes on dead tissue results in the production of a number of substances, mostly unstable, rapidly broken up into less complex combinations, but some of a permanent character, belonging to the class of alkaloids, ptomaines or cadaveric alkaloids. The number of ptomaines already discovered is very great and is being added to constantly. Most of these substances are produced in very small quantities, some are volatile, others non-volatile. Among the ptomaines discoverd up to the present, there are several which are very powerful poisons and which resemble different vegetable alkaloids, substances resembling morphine, strychnine, veratrine, atropine, nicotine, coniine and other vegetable alkaloids have been discovered in putrid bodies. Although some ptomaines resemble certain vegetable alkaloids, the similarity does not extend to all the reactions and a competent chemist is able to distinguish the one from the other. The alarm which was experienced when ptomaines were first discovered has proved groundless and experience has shown that their presence does not prevent the separation and testing of vegetable poisons.

SAPONIFICATION.

Bodies buried in damp soil, or lying in water may become transformed into a substance called adipocere. In Europe, saponification or the formation of adipocere, to any considerable extent, is said to take not less than three or four months in water, or six months in moist earth. Taylor records a case of suicide, by drowning, in which the muscles of the buttocks were converted into adipocere in five weeks and four days at longest. In Lower Bengal the process occurs with very great rapidity. Mackenzie has recorded 8 cases, one was in an advanced state of saponification when examined 4 days and 4 hours after interment, about 4½ days after death. In another case, the body of a Chinese woman was exhumed 76 hours after burial, and the external parts were found saponified. In 5 of his cases death was due to drowning, in one, recovered after three days, the body and internal organs were saponified, in another, recovered after two days, the external portions were saponified. In the case of a European lad, the body was in an advanced state of saponification, and the fleshy portions of undigested food in the stomach were converted entirely into adipocere in 7 days. Mackenzie points out that "the conditions obtaining during the rainy season in the soft and porous soil of Lower Bengal, saturated with moisture and of a high temperature, facilitate this condition of putrefaction, and in three or four days have the power of saponifying the external parts of the body, even though buried in a wooden coffin, as was the case of the Chinese woman Athow."

"The last five cases point to the fact that in the river Hooghly, during one of the months of the cold season (February) not only the external tissues of a body, but also six of the internal organs were found to be saponified in a little over 15 days; that in one case during the hot season (May) the external tissues as well as the internal organs were saponified in three days. Lastly in the hot, steamy, rainy months of September and October in three cases saponification was found, both externally and internally from 2 days to 8 days 10 hours. In the case of the lad, Chapman, the fleshy portions of the undigested food in the stomach were converted entirely into an adipocere in 7 days."

Major Moir has reported a case from Chittagong and Dr. R. S. Ashe one from Mymensingh. Dr. Ashe found "the skin of the abdomen, chest, and upper and lower extremities dry, mottled and waxy looking, and free from all offensive odour." He sent the heart, some of the omental fat, muscles and skin to the Chemical Examiner, who reported that "very partial saponification had taken place in the tissues." The case was one of a boy aged 9 years, buried on the 30th September and exhumed on the fourth day.

Adipocere is an impure ammonical soap formed by the union of fatty acids with ammonia. As found in the body it is generally of a yellow colour, occasionally white, soft, brittle, unctuous, waxy looking, and mixed with fibres and fragments of unsaponified tissue. Its specific gravity is less than that of water, it has an odour resembling decayed cheese. It is a very permanent substance and saponified parts remain unchanged for years. Saponification of the entire body is not often seen, Assist.-Surgn S. S. Mittra informs me that in December 1897 he examined a case of saponification of the whole body, which from the history must have taken place within three months.

MUMMIFICATION.

When the fluids of the body are rapidly evaporated the skin becomes dry, leathery, the muscles shrink. The internal organs are represented by a small dry mass. In all cases of mummification, putrefaction takes place in the intestines and internal organs, but the rapid evaporation of fluids prevents it going far. Mummification occurs when the surroundings of the body are favourable to rapid evaporation, hot dry air or a dry hot sandy soil. Conditions which are not met with in Lower Bengal, but may be found in the sandy deserts of Northern India. High altitudes combined with dryness are particularly favourable to mummification owing to the absence or scanty number of micro-organisms.

CHAPTER III.

THE EXAMINATION OF THE DEAD BODY.

The object of a medico-legal post-mortem examination is not confined to the finding out of the cause of death, it includes the determination of the manner in which the lesions found in the body were caused, whether they were the result of accident, suicide or homicide.

The investigation is greatly assisted, if the opportunity occurs of inspecting the body at the place where it was discovered, before it or the surroundings have been disturbed. Attention should be directed to the following points, the results recorded in writing, it is advisable to write down each point as observed. The position of the body, on a bed, on the floor, suspended, seated, etc. Its posture, the position of the limbs, especially of the arms. The state of the hands, clenched tightly, or in the semi-flexed state usual in dead bodies. If a weapon is found, its position in relation to the body; if in the hand of the deceased, note carefully whether really grasped or lying loose, retained by the position of the hand and the semi-flexed fingers, the direction of the edge of the weapon if a cutting instrument, should be carefully noted, Examine the hands for hair, fragments of clothing or other objects, and the nails for blood and particles of skin which may have been scratched from the assailant.

Note the temperature of the body, its condition as to rigor mortis, death stains and signs of putrefaction.

The expression of the face is often mentioned in medico-legal reports, placid, agonised, etc. My experience of a very considerable number of deaths from homicidal violence, is that the face has a smooth calm appearance, whatever may have been the cause of death, but distention of the veins, bruises, bloodshot eyes, smears of blood, may produce alteration in the appearance and what might be taken for a look of agony. It is a common belief that the face retains the expression it had at the time of death. In 1895, a European murder and suicide occurred in Calcutta which caused a considerable stir When I was about to begin the post mortem examination, an experienced European police officer, who must have seen many cases of violent death, pointing to the body of the murderer, said, " he has a grin of hate on his face still." I could not see it, to me the face presented the calm appearance of death and nothing more. The retention, after death, of the expression which the features presented during life could only be effected by instantaneous spasm and, we know, that is extremely rare.

The state of the dress is to be noted, whether deranged, torn, cut, stained with blood, vomit, semen, fæces, mud, sand, marked by corrosives, burning. The position and direction of arterial spurts, on the clothing, body and surroundings, must be examined and compared with wounds on the body.

Foot prints should be measured and compared with the feet of deceased.

Ligatures must be examined with great care, their material, position, manner of application and kind of knot. If the body be suspended, judge whether the deceased could have fastened the rope in the manner and in the position found.

The condition of the surroundings should be examined for signs of a struggle and of the presence of other persons. Bottles, drinking utensils, weapons found in the vicinity of the body should be examined, and, if necessary, forwarded to the Chemical Examiner.

The medical jurist should observe everything about the body and its surroundings, points apparently trivial, may subsequently prove of great importance. When as generally happens, the medical jurist sees the dead body first at the morgue, he should endeavour to obtain a detailed account of the case, before making the post-mortem examination. As a rule, the information furnished by the police is scanty and not infrequently unintelligible. I have just read the report of a case, of which the information furnished by the Police is as follows :—" The police reported that the neck of the girl was sprained which caused her death. The body was dipped under clay from head to breast ; " the post-mortem examination showed that death was due to throttling.

One reason for the scanty information which the police give, is the objection of the people to be mixed up with a police case if they can avoid it; another is the necessity of sending the body without delay, so that it may be examined before putrefaction has taken place. The local inquiry is generally very perfunctory, the villagers are mainly anxious to get rid of the whole matter and caste customs, as a rule, prevent a close inspection of the corpse.

In the mofussil, most of the bodies which the Civil Surgeon has to examine, show more or less advanced signs of putrefaction. This, in many cases, is unavoidable, the body is not discovered for hours after death and putrefaction occurs with great rapidity, the distance to the morgue is often considerable, the means of conveyance slow and not always immediately available. It has been suggested that the body should be covered with charcoal and wrapped up in mats or clean cloths. If the body, while fresh, was put into an air tight coffin filled up with fresh charcoal, putrefaction would be retarded, but anything short of this is futile and merely obscures marks of injury, and renders them more difficult of detection. If putrefaction had already begun, the air-tight coffin and charcoal would have very little effect. I may point out that saturated solution of salt fails to stop putrefaction in portions of viscera placed in it, also that a solution of Hydrarg. Perchloride 1-1000 does not prevent putrefaction in a solid organ, such as the liver, even alcohol does not penetrate with sufficient rapidity to prevent the destruction of the interior of a solid organ, unless incisions are freely made.

A medico-legal post-mortem examination should never be made without the request of the magistrate or other competent authority. The body should be identified; it is not necessary that the name of the deceased be known, the identity required is that the corpse is that to which the request for examination refers. I have heard of an instance of the wrong body being examined; there were two corpses in the morgue at the time.

The assistance of the medical jurist may be required in establishing the identity of the body. He should make a note of all marks, peculiarities, signs of avocation, etc., mentioned in the article dealing with the subject.

The post-mortem examination should be held in day light, artificial light obscures colour changes and should be avoided.

In the post-mortem room the clothes should be removed, all cuts, tears, noted, and the corresponding parts of the body carefully examined for injuries.

The body, having been undressed, should be subjected to a general inspection ; the temperature, death stains, rigor mortis and signs of putrefaction noted, with the view of arriving at a conclusion regarding the time of death. The orifices, nose, mouth, anus, urethra, vagina and ears should be inspected and their condition recorded. The hands and feet require particular attention. Having completed the general inspection, all marks of injury, bruises, wounds, burns, ligature marks, signs of corrosion, should be examined, their position, measurements and appearances described in detail.

As to the method of opening the body and the order to be followed, if there is an injury of one region that part should be examined first, but where there is no special indication, the examination may follow the course adopted in a pathological post-mortem examination.

An incision is made from the chin to a point immediately below the umbilicus, which should be passed on the left, so as to avoid the round ligament of the liver. From this point, an incision is carried to the anterior superior spine of the ilium on each side. The organs of the abdomen should be inspected but not dissected, the stomach may be tilted up and its posterior surface examined, and the position of the diaphragm ascertained by the hand. The parieties of the chest wall are then reflected, and the thorax opened, by dividing the cartilages of the ribs, as far from the sternum as possible. I find it convenient not to divide the cartilage of the first rib at this stage. Having cut through the sternal and costal attachments of the diaphragm, the sternum is forced up, it generally breaks transversely opposite the second rib. The pericardium is now opened and the condition of the heart noted, the state of the ventricles as regards distention, contraction, the presence or absence of rigor mortis ; the state of the large veins as to blood can also be seen. The fluid in the pericardium should be measured.

Up to this stage no organ has been dissected, the further course of the examination will depend on circumstances. If signs of injury or of unusual appearances have been found in the abdomen or thorax, the dissection ought in general to be begun there. If no special indication is found, the head should be examined next.

As regards the incisions for opening the body, it is to be pointed out that where an injury lies in the way of the ordinary incisions that part must be avoided.

The head is to be opened in the usual manner ; with the saw divide the bone completely, so as to avoid the use of the chisel and hammer, but at the same time carefully, not to injure the membranes or brain. In removing the skull-cap adhesions to the dura mater should be separated with the spatula or handle of scalpel.

In children the dura mater is firmly adherent to the skull-cap and cannot be separated ; having sawed the bone, the dura mater should be divided all round and removed with the skull-cap.

The sinuses and condition of the dura mater having been examined, the brain is removed and dissected in the usual manner. Effusions of fluid within the skull should be measured, the position and size of blood clots carefully noted.

After removal of the brain, the dura mater should be stripped from the base of the skull so that fractures may be looked for. The upper part of the spinal canal may be examined through the foramen magnum.

Having examined the head, the dissection of the thorax may be carried out; the cartilage of the first rib and the sterno-clavicular articulation having been divided, the sternum is removed, care is necessary to avoid opening the large veins, especially the left innominate. The cavities of the heart should be opened so as to judge of the quantity and state of the blood in them. The right side is to be examined first, the right ventricle before the right auricle, and the left ventricle before the left auricle. The condition of the valves and coronary arteries should be carefully noted. The heart may be removed, after the lungs have been dissected, for further examination. The pleura, visceral and parietal, should be carefully inspected, the lungs opened by a free incision, and their condition recorded. The pulmonary artery should be opened. The aorta may be examined after removal of the heart.

Before proceeding to the examination of the mouth and throat, it is advisable to put two ligatures round the œsophagus above the cardiac orifice of the stomach, and two round the duodenum close to the pylorus. The throat may be examined either by dividing the lower jaw at the chin, cutting the soft parts close to the inner surface of each half of the bone, and then turning the two segments outwards; or by reflecting the skin of the throat, separating the soft parts from the inside of the jaw, the tongue is drawn down, and the dissection carried back on each side to free the throat from its attachments. Traction is made on the tongue in a downward direction, the vessels at the root of the neck are divided, the aorta separated, and the whole of the throat and thoracic organs are now pulled downwards and may be completely examined. The œsophagus should be opened, the larynx, trachea and bronchi can be completely examined, the presence of foreign bodies, signs of suffocation, ulcers, &c., noted.

The examination of the abdomen comes next. The stomach should be removed unopened, by dividing between the ligatures at the œsophageal and pyloric ends. It should be placed on a clean dish, opened by an incision along the lesser curvature, its contents examined, odour, colour, consistency, character, and quantity; the condition of food as regards digestion noted.

The intestines are also to be taken out unopened, ligatures having been placed on the ilium at the ilio-cœcal valve, the large intestines may be removed separately. The contents of the small intestine, particularly of the upper part, must be carefully examined, and all morbid appearances of the walls of the intestines noted. The large intestine is examined in the same way.

The liver, spleen, kidneys are to be dissected. In all cases the stomach, its contents, portions of liver and kidney are to be preserved, pending the order of the magistrate.

The genitals, especially in females, are to be examined before and after removal from the body.

The spinal cord should be examined in all cases where injury or disease is suspected, and in cases where the cause of death is not found in other parts of the body.

CHAPTER IV.

IDENTITY.

The assistance of a medical jurist may be required in the identification of a living person or of a dead body.

The records of the law courts contain some astonishing instances of mistaken identity. A case, quoted by Hamilton, may be briefly described. A man was charged with bigamy. Among the witnesses, who swore that he was the man who married a certain woman on a date only about four years previous, were the woman, the judge, who performed the marriage ceremony, and a man who had worked with him constantly for five months. The woman was positive that the defendant was the man who married her, lived with her about three months, and then disappeared. The defendant denied that he was the person, and brought witnesses, who testified that at the time of the marriage, he was employed in a different part of the country. Witnesses for the prosecution identified the defendant by his features and by marks and scars on his neck and face, which he plainly had, but particularly by a deep scar on the ball of his foot. Witnesses for the defence included the mother of the defendant's wife, who had known him sixteen years. Counsel agreed that defendant should show the soles of his feet to the jury. No mark or scar was found on them. A register was produced which showed that the man who the defendant and his witnesses alleged he was, had been employed as a watchman at the date of the marriage, and for some months after. The jury gave a verdict of not guilty.

Mistakes as to the identity of a corpse are not surprising ; at death the face loses its expression, the features are altered. In this country, very soon after death changes take place which render identification very difficult or quite impossible, unless the deceased happened to present some deformity or some pecularity of the teeth or bones, by which he could be recognised.

The questions put to a medical jurist in cases of doubtful identity are, generally, in regard to age, scars, tatoo marks and physical peculiarities.

Scars or cicatrices result from the healing of a wound or injury, which caused loss of substance, except when the cuticle only has been destroyed. If the thickness of the true skin be penetrated, a scar results, however rapid the healing may have been. Loss of substance is replaced by granulation tissue, which is converted into fibrous tissue and covered over by cuticle. Cicatrices differ from normal skin in that they are devoid of hair follicles, sebaceous glands and sweat ducts, and poorly supplied with blood vessels. A clean cut incision, inflicted with a sharp knife, causes only an extremely small loss of substance, and if healing takes place by first intention the scar produced is a narrow line, which after a time may be almost invisible. In examining a part for scars, friction or flicking with a wet cloth will often render a scar visible, which would otherwise have been overlooked. Friction causes congestion, the healthy skin reddens, the scar being poorly supplied with vessels remains pale. A newly formed scar is red, subsequently it becomes brown, and later, pale and glistening ; no time can be fixed for these changes ; if pressed to state the date of the formation of a scar, the only justifiable reply is that "a white cicatrix indicates that the wound is not recent" (Casper.) The answer will not satisfy the questioner, and he will probably press for a definition of the word "recent." In one instance, I replied that the word was used to express the fact that the scar did not exhibit signs from which the date of its formation could be inferred.

The shape of a scar may alter, it may change from linear to oval, as the result of constant stretching. The shape may be altered artificially, which is sometimes done for aesthetic reasons, a puckered scar is cut out, the edges of the wound brought together and a linear cicatrix results.

Scars formed in childhood increase with the growth of the body.

Moles and nævi are often of assistance in identification. They may be removed but a scar results, removal of a nævus by injection, electrolysis, or subcutaneous ligature, causes a depressed cicatrix as the true skin is destroyed.

Tatoo marks are very common, and have, in many cases, formed the principal proof of identification. There has been a great deal of discussion regarding the permanency of tatoo marks. It appears beyond doubt that if the tatooing is done well, and with a carbonaceous material it is indelible, but the material must be pricked into the papillary layer of the true skin, if inserted only in the layers of the cuticle it disappears as these layers are gradually cast off. If the material used is soluble, the tatooing may gradually get faint and finally disappear. A faint tatoo mark is rendered more visible by friction. A tatoo mark may be removed by escharotics or excision, but a scar will remain.

Colour of the hair may help in identification. The colour may be artificially altered, but unless the dye is constantly applied the growth of the hair exposes the fraud.

Marks of avocation ; the hands of workmen often exhibit signs produced by the nature of the work.

The religious and caste customs of the people of India may assist in identification. The ears of all Brahmins and of most Hindus of other castes are bored. Hindu women generally wear the nose ring through the left ala, but the same custom is not infrequent among Mahomedan females, who, as a rule, bore the septum.

The native coat fastens on the right side in Hindus, on the left in Mahomedans, but at the present day coats of European cut are very much worn by all classes. In large cities, the distinctive features of dress are being gradually abandoned, and it is the same with regard to religious and caste customs, even the boring of the ears which forms part of a religious ceremony performed before the wearing of the sacred thread, is sometimes omitted. The sacred thread passes over the left shoulder and under the right arm in Hindus, in Parsees round the waist.

In India, many unidentified bodies are sent to the morgues for post-mortem examination, in most of the cases death is found to have been due to natural causes and the deceased are beggars or homeless coolies who have died in the streets or on the road side. Occasionally in murders, the deceased is not identified, and in some of these cases the appearances show that the individual belonged to the upper classes. The following is an instance. In 1894, the body of a young and handsome woman was found, in the early morning, on the side of the road running along the north of the Eden Gardens to the river. The body was well nourished, skin white, hands and feet soft, well cared for. The features and the general appearance indicated that deceased belonged to the upper class. Death was due to poisoning by hydrocyanic acid ; the woman was pregnant about three or four weeks. Every effort was made to discover who she was, the body was exposed in the Morgue until putrefaction had destroyed the features, during the time large numbers of people viewed it ; a photograph was taken on the morning of the discovery and circulated. All efforts proved unsuccessful, which is not surprising having regard to the secluded life of women in zenanas, of whom no doubt she was one.

In examining unknown bodies, all marks, scars, deformities and peculiarities should be carefully recorded. The age should be estimated ; this is very difficult. The teeth up to adult age are of assistance, and also the condition of the epiphyses as regards union with the shaft of the bones, and in the young the number and character of the teeth and the points of ossification of the epiphyses.

In a decomposed body, the sex can generally be determined owing to the resistance of the uterus and when the soft parts are completely destroyed by the shape of the pelvis.

If the corpse has been mutilated and dismembered, a careful examination should be made of the fragments, it is possible to determine the height from a single limb especially if undecomposed. The cut edges should be examined with the view of discovering signs by which the kind of instrument and the skill and anatomical knowledge of the operator could be inferred.

Stature.—An approximate estimate of the height may be obtained from the measurement of a limb. The length of the arm doubled, with 12 inches added for the clavicles and sternum, gives the distance between the tips of the fingers when the arms are stretched at right angles to the trunk and approximately the height. It is not reliable, especially in females, in whom the legs are relatively short.

The femur equals about ·275 of the stature (Quain). The length of the middle finger, measured from a point opposite the root of the thumb nail to the tip, equals one-nineteenth of the height. The hand should be placed flat on a table, and a line drawn transversely from the root of the thumb nail. The length of the forearm, from the tip of the olecranon to the tip of the middle finger, equals five-nineteenths of the height.

Twice the length of the lower extremity equals the stature. Reliance should not be placed on one of these measurements, all should be taken, and the results compared.

When bones are sent for examination the first point to decide is whether they are human. If the bones are entire, this will not be difficult, but if in fragments great care is necessary. When a number of bones are sent, the first step is to arrange them so as to build up the skeleton and to discover if there are duplicates. Having arranged the skeleton, the height can be ascertained by measuring and adding an inch and a half for the soft parts. The sex can be determined from the pelvis. It may be pointed out that the bones of the people of this part of India are smaller, thinner, smoother, with less prominent processes and impressions for muscular attachment, grooves and ridges than in Europeans ; the bones are, in fact, badly marked.

The female pelvis differs from the male in the following points :—The bones are more slender, the muscular attachments less marked. The true pelvis is shallower, wider and of greater capacity, but the false pelvis is relatively narrower than in the male, the alæ ilii being more vertical. The inlet of the true pelvis is more regularly oval, the sacral promontory projecting less into it. The sacrum is broader and flatter, and curved only in the lower part which turns forward somewhat abruptly. The outlet is larger, the tuber ischii are wider apart. The symphysis pubis is less deep ; the subpubic arch is much wider, and its margins more everted. The obturator foramina are triangular.

The angle between the neck and the shaft of the femur is smaller in women than in men.

Signs of corroborative value may be obtained from other parts of the skeleton. The bones generally are lighter, smoother and smaller in females than in males. In the skull, the face is smaller in proportion to the cranium, the jaws narrower and less prominent. The thorax is shorter and wider, the ribs more oblique ; the body of the sternum is less than twice the length of the manubrium.

Age may be determined up to adult life by the examination of ossification of epiphyses and their union with the shafts.

The only epiphysis which exhibits an ossific centre before birth, is the lower epiphysis of the femur, in which it appears a little after the eighth month, and at birth is about a quarter of an inch in diameter. About the time of birth, a centre appears in the upper epiphysis of the tibia and the ossification of the cuboid begins.

At one year of age, centres appear in the head of the femur, coracoid process of scapula, os magnum, unciform and external cuneiform.

In the second year, the lower epiphyses of the radius, tibia and fibula show centres of ossification ; in the third year, the great tuberosity of the humerus, the internal cuneiform, the proximal epiphysis of the first and the distal epiphysis of the other metacarpal bones ; in the fourth year, the lower epiphysis of the ulna, the upper epiphysis of the fibula ; in the fifth year, the great trochanter of the femur, the upper end of the radius, the internal condyle and the capitellum of the humerus ; in the ninth year, the scaphoid and trapezoid bones of the hand.

At about puberty, ossific centres appear in the external condyle of the humerus, the small trochanter of the femur, and the Y shaped cartilage of the acetabulum.

The union of the epiphyses with the shafts, and of bones with each other, occurs at different dates and therefore assists in determining age. The epiphyses become joined to the shaft in an order the reverse of their appearance, except the lower end of the fibula, in which the ossific centre appears earlier and union takes place sooner than in the upper epiphysis.

About the end of the first year, the two sides of the lower jaw unite at the symphysis ; in the second year, the union of the frontal bone takes place, beginning at the lower part ; about the 7th or 8th year, the rami of the pubis and ischium are joined by bone ; about the 16th or 17th year, the lower end of the humerus unites with the shaft, but the internal condyle which forms a distinct epiphysis, joins about a year later ; the upper epiphyses of the radius and ulna join the shaft about the 17th year ; the union of the head of the femur, and lower end of tibia occurs about the 18th year ; about the 19th or 20th year, union takes place, of the head of the humerus, lower end of radius and ulna, and lower end of femur.

In the 21st year, the upper end of the tibia joins the shaft, and epiphyses of the metacarpal and metatarsal bones unite with their shafts.

The upper epiphysis of the fibula joins the shaft about the 24th year.

In the 25th year union takes place between the second and third pieces of the sternum, between the first and second sacral vertebræ, the sternal end of the clavicle joins the shaft, the acromion process of the scapula and the crest of the ilium unite with their respective bones. About middle age, the ensiform process is united to the body of the sternum.

The ossification of the epiphyses, and their union with the shafts of the bones, can only assist, in determining age, up to the twenty-fifth year. From that period, until the alterations caused by old age occur, the bones are of little help. In advanced age, the alveolar portion of the jaws are absorbed, owing to the loss of teeth; the angle of the neck of the femur diminishes.

THE ERUPTION OF THE TEETH AND ALTERATIONS IN THE SHAPE OF THE JAWS.—At birth, the body of the lower jaw is shallow, the basal part is but little developed, the mental foramen is nearer the lower than the upper edge; the body is short, the ramus is very short and oblique, and makes an angle of about 140° with the body. The shape of the jaw alters, owing to the necessity for providing space for the permanent teeth which are more numerous than the temporary. The body becomes thicker, deeper and longer; the ramus lengthens, the angle which it makes with the body diminishes, and by adult life, when all the teeth have appeared, is nearly a right angle. In old age owing to the loss of the teeth and absorption of the alveolus, the body becomes shallower, the mental foramen is close to the upper margin, and the angle is again increased.

The temporary teeth, twenty in number, appear in the following order and time :—

Lower central incisors ...	sixth month.
Upper central incisors ...	seventh month.
Upper lateral incisors ...	seventh to ninth month.
Lower lateral incisors ...	eighth to tenth month.
First molars	eighth to fourteenth month.
Canines	eighteenth month.
Second molars	twenty-second to twenty-fourth month.

The Permanent teeth, thirty-two in number :—

First molars	sixth year.
Central incisors	seventh year.
Lateral incisors	eighth year.
Anterior premolars	ninth year.
Posterior premolars	tenth to twelvth year.
Canines	eleventh to twelvth year.
Second molars	twelvth to fourteenth year.
Third molars	eighteenth to twenty-fifth year.

The anterior and posterior premolars displace the first and second temporary molars ; the first permanent molars, which appear before any of the temporary teeth are shed, come out behind the second temporary molars. The dates given in the above list refer to European children in Europe ; no statistics, so far as I am aware, are available for natives of India ; the following figures obtained by examining Eurasian and country-born European children may be quoted, but the number examined was too small for definite results : Sixteen Eurasian boys of the average age of $15\frac{3}{12}$ years had 28 permanent teeth, the youngest was $11\frac{7}{12}$, the eldest $19\frac{5}{12}$. In the boy of $11\frac{7}{12}$ years the 28 teeth were fully developed.

Seven European boys of the average age of $17\frac{6}{12}$ had 28 permanent teeth ; in the eldest of the seven, aged $19\frac{1}{12}$, there was no sign of the eruption of the 3rd molars.

In four European girls of the average age of $16\frac{6}{12}$ 28 teeth were present ; in two, the third molars were also beginning to appear.

Ten Eurasian girls of the average age of $16\frac{2}{12}$ had 28 permanent teeth fully developed, and in five of them one or two of the third molars were present.

CHAPTER V.

DEATH FROM ASPHYXIA OR SUFFOCATION.

In this section hanging, strangulation, throttling, compression of the chest and drowning will be considered. In these conditions, death, as a rule, is due to asphyxia or suffocation, though in some, comparatively rare cases, the post mortem appearances indicate that it resulted from shock or cardio-respiratory inhibition.

Asphyxia is the commonest mode of dying, it is seen in most deaths from disease, poisons and injuries, as well as from the mechanical causes above mentioned, and which particularly interest the medical jurist. Asphyxia consists primarily and essentially of interference with the respiratory function, which is brought to a standstill, before the heart ceases to beat.

The respiratory function may be interfered with, by mechanical hindrance to the entrance of air into the lungs by :—

(1) Closure of the orifices of the air passage, which may be effected by the application of the hand, a cloth, or some other substance over the mouth and nostrils, a not infrequent method of infanticide.

(2) Closure of the air passage, by the introduction of solid or fluid substances which prevent the passage of air ; new born children are sometimes killed by a plug of cloth pushed into the pharynx or by the introduction of the finger, etc.

(3) Closure of the air passage, by compression of the neck, as in hanging, strangulation, throttling.

(4) The movements of the chest which are essential to respiration, may be prevented by pressure, as when a person is buried under fallen earth, or, as in homicide, by sitting on the chest in the case of adults, or merely grasping the thorax in infants.

(5) The movements of the lungs may be prevented by the pressure of air or fluid on their surfaces, as in cases of traumatic pneumo-thorax and pleural effusions.

This list gives the various mechanical methods of producing asphyxia, but it is caused in many other ways which may be referred to briefly. As before mentioned, in most diseases, death occurs by the gradual failure of respiration and circulation, but as a rule, the heart beats a few times after respiration has ceased, and death is due to asphyxia. In poisoning by opium and other narcotics, the symptoms during life and the post-mortem appearances are typically those of asphyxia, due in the case of opium to its paralysing action on the respiratory centre in the medulla. In poisoning by strychnine, death often occurs from asphyxia, produced by the condition of tetanic spasm of the respiratory muscles. Curara causes asphyxia by paralysing the respiratory muscles.

Changes in the blood may cause death by asphyxia. In respiration, the blood performs the function of carrying oxygen to the tissues and of removing carbon dioxide from them. Asphyxia results if the blood is so altered as to be unable to carry on these essential processes. The presence of certain substances in the blood, for example carbon monoxide, prevents it from taking up oxygen ; other substances have the effect of preventing the blood from giving up oxygen to the tissues.

Asphyxia may be caused by changes in the tissues, whereby they are unable to use the oxygen brought to them by the blood.

Sufficient has been said to show that asphyxia, the commonest mode of death, may be due to many different causes, besides the mechanical methods with which it is especially associated in the minds of medical jurists. This is a fact which should be kept in mind, particularly in India where it is a common experience, for the medical jurist, to be called upon to examine a corpse which has been discovered in a river or tank, no history being as a rule, obtainable. If the post-mortem examination shows that death occurred by asphyxia, to conclude that the case is one of drowning would not be justifiable, unless some of the distinctive signs of drowning were present, such as mud or muddy fluid in the windpipe or bronchi, or in the stomach. In such a case, unless the cause of the asphyxia is found, the proper course to adopt, is to send the viscera for chemical analysis—if no poison is present and no sign of violence, the opinion that death was due to asphyxia from natural causes may be given. What adds so much to the difficulties of the Indian medical jurist, are the absence of a reliable history and the often putrid condition of the bodies brought for examination.

The post-mortem appearances in death by asphyxia are essentially the same whatever may have been the cause; an inexperienced medical jurist may be led into error by overlooking this fact.

SYMPTOMS OF ASPHYXIA AS SEEN IN EXPERIMENTS ON ANIMALS.

A clearer conception of the post-mortem appearances will be obtained by studying the symptoms of death by asphyxia. When the respiratory function is interfered with, symptoms rapidly appear; within a few moments, there is a feeling of suffocation which is quickly followed by forcible respiratory movements, due to the stimulation of the respiratory centres by the impure blood. The movements increase in force and frequency up to a certain point, after which, they gradually get weaker and slower. The period of forcible movements lasts about one minute in animals. As the respiratory movements get weak and slow, the animal becomes unconscious and convulsions occur—the inspiratory movements are markedly weaker than those of expiration. This period also lasts about one minute, and is suddenly succeeded by a condition of exhaustion and collapse, due to the paralysis of the respiratory centres by the impure blood. The animal lies in a state of profound insensibility, the reflexes are lost, the pupils widely dilated, the muscles flaccid, the respiratory movements consist of an occasional sudden gasping inspiration, the intervals become gradually longer, the inspirations weaker, finally, all movement ceases. The heart which has gradually become weaker, continues to beat for a few seconds after the respiratory movements have stopped.

The phenomena of asphyxia are fairly constant but the duration varies. The stages are best marked in young well nourished animals in whom the three periods—(1) violent respiratory efforts, (2) strong expirations and weak inspirations, loss of consciousness, and convulsions, (3) the final inspiratory movements, exhaustion and collapse, are, as a rule, clearly defined, but not infrequently the animal dies without going through well defined stages.

POST-MORTEM APPEARANCES OF ASPHYXIA.

The external appearances are not distinctive, death rigidity occurs at the usual time, its appearance depending on the vitality existing in the muscles. If this is diminished by violent convulsions, rigor mortis occurs early; if on the other hand, the muscles are in a vigorous, unexhausted condition, the onset of rigor mortis is delayed and its duration prolonged. Death stains appear early and are well marked, because the blood is fluid and coagulates slowly.

Putrefaction occurs somewhat earlier than usual, especially in full blooded individuals who have died of slow asphyxia.

The appearance of the face is generally the same as in death from other causes—cyanosis, protrusion of the eyeballs, injection of conjunctivæ, are rarely seen in the post-mortem room, though present during the asphyxia. The reason is, after death the body is laid on the back, and the blood being fluid gravitates from the face. In some cases, cyanosis is still apparent after death. Minute ecchymoses or hæmorrhages in the skin of the face, about the eyelids, lips and nose, are not uncommon, especially in asphyxia due to certain causes. They are occasionally seen in the skin of the neck and upper part of the chest. They occur in other parts but are not so evident. In the subcutaneous tissue of the scalp, minute ecchymoses and even larger hæmorrhages are frequently found.

These minute skin hæmorrhages are due to rupture of capillary vessels, caused by the rise of blood pressure during the earlier period of the asphyxial process.

Pupils.—In the last stage of asphyxia, when the individual is in a condition of complete insensibility, the pupils dilate widely. This occurs even in cases of opium poisoning, in which pin-hole pupils are present until coma becomes profound.

Though dilated at the time of death, the pupils subsequently diminish in size and, at the time a post-mortem examination is usually held, are of medium size.

Emission of Semen.—Seminal fluid is often seen on the thighs and about the genitals in cases of asphyxia from mechanical causes, but it is also found in deaths from disease. During the period of convulsions in the asphyxial process, ejaculation of semen, discharge of urine and fæces may occur, due to irritation of the lumbar cord, but in most cases where these discharges are seen, they are not produced by active vital contraction, but take place after death when the sphincter muscles relax.

INTERNAL POST-MORTEM APPEARANCES.

The blood is of a dark red colour and fluid. The colour is due to the diminution in the quantity of oxygen and the consequent reduced state of the hæmoglobin.

In most cases of asphyxia, the blood is fluid even when the examination is made many hours after death ; it is not characteristic, for it is met with in sudden death from different causes, and in some cases of asphyxia the blood in the heart and great vessels may be coagulated and the coagula may be decolorised, though more often they are dark red.

There is, at present, no satisfactory explanation of the fluidity of the blood in death from asphyxia, the presence of an excess of carbon di-oxide and that the walls of the vessels retain their vitality have been suggested. It may be pointed out that the blood, though fluid within the blood vessels and heart, coagulates quickly when removed, moreover, if it is extravasated into the tissues or spaces of the body, in these situations it coagulates.

The fluid condition of the blood explains the formation of hypostases in the dependent parts of organs and tissues.

VENOUS HYPERÆMIA of the lungs with marked hypostasis of the dependent portions, is one of the most constant signs of death by asphyxia. This condition is due to the diminution of the air pressure within the lungs during the process of asphyxia, and the consequent lowering of the pressure on the capillaries in the walls of the air vesicles. These vessels enlarge, become distended with blood which tends to stasis in them, the blood pressure is raised and when it reaches a certain height, exudation of serum takes place into the lung tissue and air vesicles. The longer the asphyxial process lasts, the greater the hyperæmia and the larger the quantity of serum which escapes into the lung tissue and air vesicles. When an individual dies slowly of asphyxia and the third stage is prolonged, the lungs are filled with blood and serous fluid, on section large quantities pour out, the bronchi and trachea are filled with frothy fluid, lathery froth may exude from the nostrils.

It is, however, the experience of every medical jurist to meet with cases of asphyxia, in which the lungs contain no excess of blood or fluid.

When the distribution of the blood in death by asphyxia is examined and the examination, as usual, takes place some hours after death, it is found that the right side of the heart, the pulmonary artery and the venous system are distended, while the left heart is empty or nearly so. Great stress is laid on the distended condition of the right heart, pulmonary artery and great veins and upon the emptiness of the left side as a sign of death by asphyxia. Undoubtedly it is a sign of great value, the causation of which has been much discussed. From experiments made by various observers, it appears that in animals killed by mechanical asphyxia, the heart stops with all its chambers full of blood. Professor Dr. Fritz Strassmann has investigated the effects of rigor mortis on the heart, and has shown that it produces contraction of the organ ; the latest paper of his, I am acquainted with, is published in the supplement to the *Vierteljahrsschrift für gerichtliche Medicin, 1896.* From his researches and those of other investigators, it would appear that the characteristic condition of the heart in asphyxia, seen when the examination is made some hours after death, is the result of the contraction produced by rigor mortis, which, in the left ventricle, results in the complete or almost complete emptying of that cavity.

The explanation of the continued distended condition of the right ventricle is, probably, the weak muscularity of its walls, and the fact that it dies slowly and gradually so that rigor mortis comes on late and does not occur in the whole of the ventricle at the same time, but affects the fibres in successive groups. Hence in the right ventricle, the contraction produced by rigor mortis is slight and incapable of expelling the blood.

The condition of the vessels of the brain and its membranes, in death by asphyxia, is subject to great variation, as a rule the vessels are well filled ; sometimes, there is marked hyperœmia, not infrequently the quantity of blood in them is small. It is well, in judging the state of the cerebral vessels, to bear in mind the effect of gravitation ; if, as usual, the body has been lying for several hours on the back, on a table or other flat surface, the vessels of the posterior part of the brain and its membranes will be distended with blood, those of the front nearly empty.

Venous congestion of the abdominal organs is also present, not only is the quantity of blood in the veins increased, but its hypervenous condition enhances the appearance of congestion.

SUB-PLEURAL and SUB-PERICARDIAL ECCHYMOSES, also called TARDIEU SPOTS. These are minute extravasations of blood from ruptured capillaries, varying in size from a pinhead to a linseed, occasionally larger, taking the form of small splashes. They may be numerous, scattered over the surfaces of the lungs and heart, and in the tissues of the anterior and posterior mediastinum. More often, they are few in number and found only on the posterior surface of the lungs and between the lobes, and on the heart at the base of the ventricles. They are rarely seen on the parietal layer of the pleura or pericardium. The largest are found in the posterior and dependent parts, which is explained by their increase in size after death, by gravitation of the blood through the ruptured capillaries. It is important to note that these capillary hæmorrhages are not found in most cases of death from asphyxia. They are very seldom seen in death from hanging, this will be referred to in the chapter dealing with hanging ; and even in asphyxia due to strangulation or throttling they are not generally present.

The rupture of the capillaries occurs during life, and is generally held to be due to the increase of the blood pressure which takes place during asphyxia, but some authorities hold that it is caused by the aspiratory action of the chest, the walls of which, raised by muscular action, pull on the surface of the lungs as a cupping glass pulls on the skin.

It is probable that the production of capillary hæmorrhages is dependent on more than one factor ; experiments on animals go to show that they are caused during the period of strong expiratory efforts rather than during the stage of final inspirations, and that they are absent in cases in which convulsions have not occurred. As regards human beings, it is well-known that capillary hæmorhages are most frequently found in the cases of asphyxia in children and old persons, much less often in the bodies of adults ; from this it would appear that the state of the capillary walls and the tissues is a factor of importance.

Besides the situations mentioned, capillary hæmorrhages are also found in the mucous membrane of the respiratory tract—in the bronchi, trachea, larynx, nose, also in the conjunctivæ, in the external auditory meatus, in the scalp frequently, sometimes in the dura mater. Bleeding from the conjunctivæ, ears and nose commonly seen in cases of throttling and strangulation, is due to capillary hæmorrhages in situations where the tissues are delicate and in consequence the blood makes its way to the surface.

The importance of capillary hæmorrhages appears to have been greatly exaggerated; as a matter of experience, medical jurists find they are of infrequent occurrence, and it is well to recollect that they are found on the lungs and heart and in other situations in cases of septic disease, scurvy, purpura, etc.; they are not characteristic of mechanically induced asphyxia, and, as will be shown later, are extremely rare in asphyxia due to hanging.

In the *Vierteljahrsschrift für gerichtliche Medicin* of January 1895 Professor Dr. Kratter has described a form of capillary hæmorrhage to which he assigns considerable value, in the diagnosis of mechanically induced asphyxia, particularly drowning and hanging, but not in cases where death resulted from compression of the chest. He observed these hæmorrhages also, in asphyxia due to internal causes, tetanus, epilepsy, death from electricity. He notes that they are absent in asphyxia of new born infants, and nearly always present in asphyxia of adults, whereas subpleural and subpericardial ecchymoses are especially common in children and comparatively rare in adults. The hæmorrhages, he describes as occurring along the posterior surface of the thoracic aorta, particularly at its lowest part, and he attributes their origin to the stretching of the aorta, during the violent respiratory movements of asphyxia. He considers the aorta as being fixed at the diaphragm opening, and above it hooks over the left bronchus, it is, according to Kratter, fixed at these two points, below and above, and if, during asphyxia, the movement of the chest is great, the intervening portion of the vessel will be so stretched that the capillaries in the tissues about it, are torn, the blood escaping from them, forms small hæmorrhages along the posterior surface of the aorta.

Every medical jurist is anxious to add to the reliable signs of asphyxia, and on reading Professor Kratter's paper I carefully examined several cases of asphyxia in adults, produced by different causes. The examination was made with great care, the lungs were lifted, the pleuræ divided and the aorta exposed without being disturbed ; the result was no hæmorrhages were found. Subsequently it was noticed that if the thoracic organs were removed in the usual manner, cutting across the trachea, œsophagus and vessels at the root of the neck, then pulling out the contents of the thorax, hæmorrhages of various sizes, some as small, others larger than the spots to which the term capillary hæmorrhage is usually confined, were found along the aorta. The conclusion come to was that the hæmorrhages described by Prof. Kratter were the result of the manipulation during the post-mortem examination.

CHAPTER VI.

THE symptoms and post-mortem appearances of asphyxia having been described, attention will next be directed to the principal mechanical methods of producing death in this way and to the special post-mortem signs by which they are distinguished.

Asphyxia may be caused by closure of the air-passage in the neck by pressure from without, as in hanging, strangulation, throttling.

These three ways of producing asphyxia are of the greatest medico-legal importance, and will, therefore, be studied separately and in considerable detail.

HANGING.

Hanging occurs when the body is wholly or partially suspended by a noose around the neck, the noose being tightened by the weight of the body. The constriction of the neck closes the air-passage and compresses the vessels and nerves.

THE MECHANISM OF DEATH BY HANGING.

Hanging is usually effected in the following manner :—The individual stands on a chair or table, and ties one end of a rope or cloth to a beam or hook above his head, with the other end he makes a noose round his neck. He then steps off, the descent of the body is arrested by the rope, the neck slips through the noose until the latter is tightened by the weight of the body, generally the noose encircles the neck obliquely and in front lies on the thyro-hyoid space, passing along the sides of the neck obliquely upwards to the sterno-mastoid muscles, thence to the back of the head it rests on the hair. The pressure of the noose on the throat carries the hyoid bone and the root of the tongue, upwards and backwards against the posterior wall of the pharynx, so blocking the space and preventing the passage of air. If the noose is still further tightened, the root of the tongue is carried up into the pharynx, the uvula and soft palate are pushed up. The root of tongue being carried upwards, the body of that organ is pushed forwards and the tip is pressed against the teeth, or if the mouth is open, protrudes and is caught between the teeth when the jaws close. The protruding portion is cyanosed, and the cyanosis does not disappear when the corpse is cut down and laid in the usual supine posture, as the pressure of the teeth prevents the gravitation of the blood from the part.

If the noose was drawn tight before suspension, its position will not alter much, and in these cases it usually lies on the thyroid cartilage, below the pomum Adami, and the thyroid cartilage, carried upwards and backwards, is spread out and flattened against the spine.

Occasionally, the noose is so arranged that the knot is in front and when suspension takes place the weight of the body drags on the noose, the chin is tilted upwards, the head is thrown back, the noose encircles the neck obliquely from behind upwards and forwards to the chin. The air-passage is closed by the pressure of the noose on the sides of the neck, the vessels and nerves are also compressed.

The commonest position for the knot is on one side, below the ear, usually the left. The noose encircles the neck obliquely, being lowest on the side opposite to the knot, crossing the throat over the thyro-hyoid space.

The compression of the vessels and nerves by the noose is an important effect. The carotids are, as a rule, compressed at the bifurcation, that they are compressed is shown by the fact that in a suspended body, fluid cannot be injected beyond the noose, except by using great force.

When an individual is suspended by a noose around the neck consciousness is lost immediately, and this explains why in accidental and in suicidal hanging, the victim makes no attempt to save himself, although the circumstances may be such, of which examples will be described, that a slight effort would have been sufficient ; it is well known that suicide, attempted by other means, is not infrequently stopped by the voluntary effort of the individual, but when hanging is the method selected, this never occurs.

The cause of the immediate loss of consciousness which follows the tightening of the noose has been much discussed ; that it is due to closure of the air passage is negatived by the fact that breathing may be stopped for thirty or forty seconds or longer, without conciousness being lost. The results of experiments on animals and on men who voluntarily submitted, show that compression of the carotids or of the pneumogastric nerves causes loss of consciousness. The effect of compression of the carotids is to suddenly cut off the main supply of blood to the brain, causing great disturbance of the cerebral circulation and pressure ; to these the loss of consciousness may be attributed. The effects are produced, notwithstanding that the supply through the vertebrals continues, these vessels are small, and the collateral circulation is not immediately expanded to an extent sufficient to compensate for the cutting off of the carotid supply.

In the production of loss of consciousness, the compression of the pneumogastrics is also an important factor ; it has been experimentally proved that pressure on these nerves alone is sufficient to produce it and pulselessness.

The peculiar feature in hanging is that, in almost every case, as soon as the noose tightens round the neck, the individual becomes unconscious ; and in most cases, death occurs rapidly ; it is the most rapid means of causing death by asphyxia. The explanation of the unconsciousness and rapid death is that the noose not merely closes the windpipe, it also compresses the carotids and pneumogastrics whereby the brain and heart are directly affected.

POST-MORTEM APPEARANCES.

External appearances.—In most cases of hanging, the face presents the pale, smooth, waxy appearance, common to death from all causes.

Cyanosis, petechial hæmorrhages, bleeding from the eyes, ears and nose, protrusion of the eyeballs, are very rarely found, and are only likely to be observed in florid, full-blooded individuals, and when, owing to the position of the noose, one side or a portion of the neck, is not compressed and consequently blood continues to flow to the head until the heart stops.

The lips are pale, often coated with dry saliva. In many cases, dried saliva in silvery streaks is found extending from the dependent angle of the mouth to the side of the jaw and down the front of the body, even to the legs. The streaks are sometimes reddish, rarely from blood from cuts on the tongue caused by the teeth, more often in this country from betel. The discharge of saliva is due to pressure of the noose on the salivary glands. It was present in 54 out of 128 cases.

The tongue is raised by the tightening of the noose, and the tip rests against the teeth or protrudes. Protrusion of the tongue was found in 54 of my 128 cases. The amount of protrusion varies from merely the tip between the teeth, to a considerable portion projecting beyond the lips. The protruding portion is, as a rule, deeply cyanosed and marked by the teeth. The cyanosis proves its vital origin ; as will be mentioned later, in some experiments undertaken to test the applicability to India of Casper's statement of the post-mortem formation of the noose mark on the neck, it was noted that when the body was suspended, the tongue which had been resting on the floor of the mouth was lifted up and pushed forward so that the tip rested against the teeth, there was no actual protrusion, but from the appearance it seems quite probable that protrusion might occur in a post-mortem suspension.

Protrusion of the tongue is a sign of considerable value and should always be looked for ; it is well however to recollect that it is met with in death from natural causes, from poisoning, injury, and also from other mechanical methods of producing asphyxia.

If the body is taken down soon after death and placed in the usual posture, death stains occur in the usual situations, but if it remains suspended, they develop in the feet, legs, thighs, in the hands and forearms ; the upper part of the body is pale and presents a marked contrast to the livid legs and forearms. The longer the suspension, the more pronounced are these appearances, and the fingers, and to a less degree the toes, become swollen and cyanosed. The above described distribution of post-mortem stains is not a proof of suspension during life, for it would occur equally, in a corpse suspended before the blood had coagulated.

In bodies which have been long suspended, besides death stains, capillary hæmorrages are often seen in the skin of the legs and forearms. They are small circular spots, slightly raised and of a dark colour, scattered irregularly over the legs and forearms, most numerous in the skin over the shins and inside of the legs, and the lower part of the forearms. Their origin is a subject of discussion ; some authorities hold, they are produced after death by the rupture of small vessels, caused by the pressure of the blood gravitating into the limbs. This view is supported by the distribution of the hæmorrhages, which are most numerous on the lower part of the legs, the smaller number on the feet would be accounted for by the firmer texture of the skin and tissues. Other authorities hold, they are of vital origin produced during the asphyxial process, by the increase of blood pressure, but that they only become evident after death when enlarged by the escape of blood from the vessels distended by gravitation of the blood into them, and hence are only seen in cases of long suspension.

Mark of the noose on the neck.—This is the most important of the external signs of hanging ; the characters it presents depend on the nature of the ligature, its position, and the manner of suspension.

In the 128 cases of hanging referred to, suspension was by a rope in 73 ; by a cloth in 54 ; in 1, the kind of ligature was not ascertained with certainty, it was, most probably, a rope. The ropes used were of all kinds, hard coir to soft cotton ; in some cases string. The cloths were generally dhotis or chudders in the case of men, sarees were used by women. They were mostly soft, and when twisted into rope shape, as was usually done, formed a thick soft mass which produced a broad superficial impression with little or no injury to the surface.

If a running noose is placed loosely round the neck with the knot behind and the body suspended, the noose will be found encircling the neck obliquely, and the mark caused by it will correspond. A small, hard rope will produce a deep, narrow furrow, in front, over the thyro-hyoid space, passing obliquely upwards along the sides of the neck, crossing the sternomastoids near the mastoid process, and beyond this, either a faint impression on the hair or altogether absent.

If the knot is at one side, the mark will be deepest and lowest on the opposite side; if in front, the deepest portion is at the back of the neck, and at the front there will usually be no mark, or an irregular impression, caused by the pressure of the knot against the chin. If the noose was drawn tight before suspension, it will not move much, the mark will, generally, be below the pomum-Adami, and nearly horizontal.

The presence of clothing on the neck, or of a thick beard, may interfere with the formation of the mark by preventing the noose from pressing on the skin. Buttons or other hard objects caught beneath the noose, or knots on the ligature may cause round marks which may give rise to the suspicion of throttling and suspension after death.

The completeness of the mark depends mostly on the kind of ligature, a running noose of smooth rope will be drawn tight round the neck by the weight of the body, whereas a noose of rough rope will probably not close down but will form an open loop near the knot, and there will be no mark at this part of the neck.

A cloth, generally, produces an incomplete mark, as the noose does not run freely, it is also broad and shallow, but a hard cloth tightly twisted makes a mark resembling one caused by a rope.

The appearances of the mark depend on the duration and character of the suspension and on the length of time between death and the examination.

If the body is cut down and the noose taken off immediately after death, and the neck examined without delay, the mark will be a soft, moist, shallow impression; if suspension was complete and continued for a considerable time, and the noose was left untouched after the body was taken down, the mark will be a hard, yellowish brown furrow of the consistence of parchment, the depth will depend on the kind of ligature, a thin hard rope will press more deeply than one of larger size and soften texture, a soft cloth will produce a broad shallow depression.

The parchment-like consistency of the floor of the mark is the result of abrasion of the cuticle and subsequent drying of the surface by evaporation. Time is required for its development, and it is more pronounced when the surface is extensively abraded, as occurs when a rough rope was employed. As a rule, in suspension with a soft cloth the parchment-like consistency is produced only where the twists and ridges in the cloth pressed on the skin. Its development requires time ; and can be prevented by keeping the surface moist.

The colour of the mark varies with the colour of the skin, dark brown to light yellow. Patches or streaks of red, due to blood extravasated from ruptured capillaries, are very rare. They were not found in any of the 128 cases of suicidal hanging previously mentioned, though in many of these cases the suspension was by ropes and cords of the hardest roughest kind, such as coir used in tying the bamboos of a scaffolding.

The noose is often formed by doubling a rope or cloth and passing the ends through the loop, no knot being made, a double mark is caused on the neck, in places separate with band of skin between, in others crossing and blending, producing an irregularly ridged appearance. The skin intervening between the marks may be swollen and injected, and occasionally a row of small vesicles filled with serum may be found on it. Small vesicles may also be found on the summit of ridges.

The noose may be formed of several loops of string which if the body was suspended for a considerable time, press deeply into the neck, producing a number of furrows, blending and crossing irregularly.

In one of my cases there was one turn of rope round the neck, crossed behind and passing obliquely forwards to the chin, on the neck there was a horizontal mark encircling the neck completely, and an oblique mark extending from behind forwards. In another case, the ligature was made of two pieces of rope of different size and texture, one thin and hard, the other soft and flat, joined by a clumsy knot; the mark on the neck exhibited the different characters of the ligature, one portion was a narrow, deep, hard furrow, the other a superficial, soft impression.

Marks caused by cloths differ much, generally they are broad and shallow, parchment-like only in places. In India, the cloths used in hanging are cotton shawls and dhotis by men, muslin or cotton sarees by women, all of which are soft and produce a broad soft impression. If a hard cloth, for example a coarse handwoven sheet, is used, the pattern may be distinguishable on the floor of the mark which will also be abraded and consequently dry and hard where the pressure was greatest.

In cases where the suspension was partial, or if the body was cut down within a few minutes, the mark caused by a soft cloth is very faint, and though at first discernible may completely disappear. In January 1898, two young women, aged 14 and 18 years, were left together in a room at 9 A.M., half an hour later an inmate of the house who had been out, returned and found the door of the room closed from inside. He called to the women but got no reply, he then went round and managed to get into the room by another door. He found both the women hanging, suspended by cloths round the neck fastened above to the bamboo beams, thinking they were still alive he took down both the bodies, one was dead, the other showed signs of life, he removed the cloth, sprinkled water on her face and called out for help, the girl died within a few minutes. When the police arrived at the house, the officer saw a reddish mark on the girl who was living when cut down. I held the post-mortem examination about 22 hours after death. There was a faint slightly reddened mark on the neck; it was oblique, lowest and most distinct on the right side, in other parts so faint as only to be visible when viewed in an oblique light. The police officer, an experienced observer, told me that the mark was much more distinct when he saw it at the house.

On the other body, the noose was still round the neck, the turn, there was no knot, being behind on the right side, the mark was broad, faint and oblique, passing from the thyro hyoid space along the sides of the neck, absent behind, the surface was soft.

In another case examined in February 1898, a girl aged 13 years was reprimanded for some fault and went and locked herself into her room; her mother followed in a few minutes and failing to get a reply, forced the door open. She saw her daughter hanging by means of a saree, she called for assistance and with the help of another inmate, took the girl down. The girl was living, they laid her on the floor, sprinkled water on her face and poured some milk into her mouth. A medical man was sent for. When he arrived, about twenty minutes later, he found the girl dead. I held the post-mortem examination about four hours after death, there was no mark of suspension on the neck, the trachea and large bronchi contained milk, there was froth in the smaller bronchi. The general appearances showed death had occurred by asphyxia.

THE INTERNAL APPEARANCES.

Having examined and noted the external appearances of the body generally, and the position, character and direction of the mark on the neck, and determined whether the mark could have been caused by the noose found on the neck, or which was said to have been found on it, the examination of the internal appearances should be carried out. The most important of these is the state of the tissues of the neck beneath the mark, and they should be examined first. With a sharp scalpel make two incisions round the neck, one an inch above, the other an inch below the mark, join the two by a vertical cut and dissect off the ribbon of skin. Care must be taken in making the incision, and in dissecting off the skin, not to open veins.

The subcutaneous tissues beneath the mark are dry, condensed, presenting the appearance of a whitish band. It is the result of the pressure of the ligature and is consequently best marked when a rope was used and the body was suspended freely and for a long time. A soft cloth does not press into the tissues, and consequently the dry condensed appearance is only slightly developed, especially if the body was cut down soon and the ligature removed. With every kind of ligature firm compression for some time is required to produce the white band in the subcutaneous tissues.

As a rule, except in judicial hanging, the neck shows only the mark as above described and no other sign. Occasionally, in my experience very rarely, signs of injury to the tissues of the neck are present; extravasations of blood, tearing of muscle fibres fracture of the hyoid bone and cartilages of the larynx, fracture or dislocation of the spine have been met. I found fracture of the processes of the hyoid bone and thyroid cartilage in a few cases, three or four, out of 128 cases of suicidal hanging, and in these instances the processes were unusually long and fragile. Fracture of the thyroid cartilage is only likely to occur when the noose rested on it.

Fracture or dislocation of the spine was not present in any of my cases ; it may be pointed that in examining a decomposed body, separation of the bodies of the vertebræ is easily caused owing to the softened condition of the intervertebral discs, and, if, during the post-mortem examination, the head is allowed to fall back after a block has been placed beneath the shoulders, or if it be pressed back when opening the skull, a separation of vertebræ, which may possibly be attributed to the hanging, is easily produced. Rupture of the lining of the carotid arteries is sometimes found. In one case, examined with Dr. Mackenzie, a wavy transverse rupture was present in the carotid of one side, it was about half an inch long. Between June 1893 and December 1895, in every case of hanging examined at the morgue, rupture of the lining of the carotids was looked for, it was not found once, thirty-five cases were examined.

Rupture of muscles, extravasations of blood in the tissues of the neck were not found in one of the 128 cases examined up to November 1900.

The lungs are nearly always congested, but the degree of congestion varies greatly ; in many cases it is marked and accompanied by serous exudation into the lung tissue and air vesicles. In these cases, blood and serum pour from the cut surface, the trachea and bronchi are filled with froth ; sometimes a bunch of lathery froth is found about the nostrils, an appearance which is held to be one of the most valuable signs of drowning but which may also be present in asphyxia from other causes.

Various explanations have been put forward to account for the very marked differences in the quantity of blood in the lungs in cases of hanging.

Formerly death from hanging was attributed to asphyxia when the lungs were found full of blood, and to what was called apoplexy, when congestion of the brain was marked, and in those cases in which both the lungs and brain were hyperæmic to a combination of apoplexy and asphyxia. It was supposed that asphyxia occurred in those cases in which the effect of the ligature was most marked on the air-passage, and apoplexy when the blood vessels were principally affected.

The more probable explanation is that the amount of blood in the lungs depends on the intra-thoracic pressure ; if the windpipe is closed at the end of expiration, the intra-thoracic pressure being low, blood passes freely into the lungs and accumulates in them, its escape being hindered by the higher pressure on the vessels beyond the thorax. If the closure takes place at the end of an inspiration, the intra-thoracic pressure is high, the flow of blood into the thorax is impeded, and the high pressure also assists in emptying the thoracic vessels.

This theory, which is put forward by Patenko, is supported by the results of the experiments which he made on animals.

In the 128 cases of hanging previously mentioned the quantity of blood in the vessels of the brain was never strikingly great, nor sufficient, in my opinion, to produce a condition of apoplexy, as a rule, the vessels of the pia mater over the front of the brain were more or less empty, those of the posterior and dependent portion distended, the result no doubt of gravitation, after the body was placed in the supine position.

The pulmonary artery, right side of heart and venous system are distended with dark, fluid blood.

If the suspension has lasted for a considerable time, the peritoneum, visceral and parietal, at the lower part of the abdomen is red ; and reddish fluid, two or three ounces, sometimes more, is found in the pelvis. The pelvic organs and the dependent coils of the intestine will also be hyperæmic.

Capillary ecchymoses or Tardieu spots on the pleura and pericardium are very rare in hanging, not in one of my 128 cases.

DIAGNOSIS OF DEATH BY HANGING.

Having considered the post-mortem appearances, the important questions to be decided are, do they in most cases of hanging exhibit such characteristic features as to enable the medical jurist to give a definite opinion ; or can similar appearances be produced in a body suspended after death ; and if this be the case, how is the medical jurist to decide the cause of death in cases of alleged hanging ?

In the foregoing description of the post-mortem appearances of hanging, it will have been noticed that the internal signs are those of death by asphyxia, and that the ligature mark on the neck exhibits no sign of vital reaction. It is the result of compression by the noose drawn tight by the weight of the body, the parchment-like texture of the surface, the dry condensed condition of the subcutaneous tissues under the mark are also due to pressure.

Rupture of muscles, or of the internal coat of the carotid arteries, fractures of the hyoid bone or of the cartilages are very rare. In the few instances where fractures were discovered among the cases examined at the Calcutta morgue, no sign of vital origin was present at the site of the injuries. It seems probable, that in many of the reported cases in which injuries to the structures of the neck were observed, they were produced either in taking down the bodies, or during the manipulations at the post-mortem examination. It is possible that the greater weight and bulk of the bodies of Europeans explain the more frequent finding of these injuries in Europe. It may, further, be observed that, apparently in Europe as in India, these injuries do not exhibit signs of vital reaction.

The mark on the neck is produced after death, as Casper and others have demonstrated. With the view to determine whether the results of suspending a dead body in this country would be in any way different from those described by Casper, on the 7th December I suspended, by a rope round the neck, the body of a man, one hour after death, and left it hanging for five hours. Before suspension, the position of the tongue was noted, it lay back in the mouth, not touching the front teeth, rigor mortis was absent. A running noose of rope was used and a short drop of about eighteen inches was given. The noose tightened in the usual position, in front in the thyro-hyoid space, passing obliquely upwards to the back of the head where it lay on the hair.

After suspension, the tongue was found to be raised up behind and the tip pressed against the teeth, it did not protrude, but it bulged into the space from which the right lateral incisor was absent, and on taking down the body, the margin showed impressions of the teeth. When the rope was removed, a deep furrow was found on the neck, deepest in front, over the thyro-hyoid space, slightly hardened. A portion was dissected, the tissues beneath were dry and pale. On the following morning, the parchment-like character of the floor was typical, showing that, to produce it in marked degree, several hours are required.

The mark was in every respect similar to that found in cases of death by hanging, the only difference detected was in the state of the veins of the neck. These in hanging are, usually, distended; they were very empty in this case, which, as the man was emaciated and had died of diarrhœa, is not surprising.

On the same day I placed several turns of rope as tight as possible and securely tied, round the neck of a man, who had died of cerebro-spinal meningitis and had been dead about half an hour. The rope was left on for sixteen hours, on removal a broad ridged mark was found, only slightly hardened, but after a few hours exposure it became typically parchment-like. The tissues of the neck were not injured.

On the 10th December, two bodies were suspended by running nooses, formed of doubled ropes, and left hanging for fourteen hours, a drop of between two and three feet was given. In one, of a man who had been dead twelve hours, the noose was arranged so that the turn, there was no knot, was on the left side, behind the ear; rigor mortis was well marked, the mouth was partly open, the tongue lying back. After suspension, the tongue was found raised and pressed forward, and a few drops of saliva trickled from the dependent angle of the mouth down the side of the jaw.

In the other body, rigor mortis absent, the noose was applied so that the turn was in front at the chin.

In both, when examined after fourteen hours suspension, typical noose marks were found, with a hard parchment-like surface and a dry white band in the subcutaneous tissues.

These experiments show that Casper's conclusions hold good for India, and it may be accepted that a noose mark, differing in no way from one caused by suicidal hanging, can be produced by suspension after death.

How is the diagnosis of death by hanging to be made ? By a complete examination of the body and a careful consideration of the circumstances of the case. If seen in the position of suspension, the medical jurist should note the manner of the fastening of the ligature, and judge whether it was possible for the deceased to have reached the spot where the upper end was fastened, marks of disturbance in the room, signs indicating a struggle, blood marks, etc., should be looked for. When the body is taken down the material, and position of the ligature, character of the knot should be noted and compared with the mark on the neck.

In this country, the medical jurist has constantly to face the difficulty, caused by absence of reliable history and the putrid condition of the body he is called on to examine. In no cases are a reliable history and absence of putridity of greater importance than in cases of alleged hanging. If the body is fresh, the appearances of asphyxia well marked and no other cause for them discovered, the noose mark on the neck justifies the conclusion that death was due to hanging. If, from decomposition or other cause, the signs of asphyxia are indefinite, it is advisable to defer opinion until the result of the analysis of the viscera is known. It may be pointed out that the quantity of blood in the lungs in cases of hanging varies, and signs of asphyxia may be slight or absent, in such cases analysis of the viscera is necessary.

Having come to the conclusion that death was due to hanging, the further question is, was the hanging the result of accident, suicide or homicide ? The first contingency may be dismissed in a few words, accidental hanging is extremely rare and occurs under circumstances which disclose the character of the case.

Suicide by hanging is very common, it comes next to opium as a mode of suicide in Calcutta. Between June 1893 and November 1900, excluding three months absence on leave, I examined 128 cases of hanging in the Calcutta morgue. In not one was there any suspicion of homicide, nor appearances which could give rise to such suspicion. I have not included a case of death from cyanide of potassium and hanging ; it will be described with the poisons.

Of the 128 cases, 50 were men ; 78 women, several of the women were mere girls, fourteen or fifteen years old. A rope was employed by 27 men and 41 women ; a cloth by 22 men and 37 women ; in one case the kind of ligature could not be ascertained, though from the character of the mark it was most probably a rope. A short account of the case will illustrate the difficulty of obtaining a straight forward history in even a simple case. The deceased, a young man, lived with his father ; the hut consisted of two rooms, one on the street, used as an ice-shop in which the father lived, the other behind it, occupied by the son who had been ill with chest disease for several months. The father's evidence at the Coroner's inquest was that he and his son went to sleep about 9 o'clock, that about 2 A.M. he got up to serve a customer and saw his son asleep, at 5 A.M. he woke up and found his son dead. With the assistance of friends he removed the body to the burning ghat where the sub-registrar in viewing it noticed a noose mark on the neck and informed the the Police. I held a post-mortem examination ; there was a typical noose mark, the internal signs of asphyxia and chronic lung disease, and the opinion was given that deceased died of hanging. The father maintained his statement, the only entrance to the son's room was by the door from the shop.

In several of the cases suspension was partial only, in one, a woman hanged herself with a cloth, the end fastened to a hook in the wall at such a height that when suspended the feet of the deceased were on the floor, extended in front of the body.

The woman with her husband and three children lived in a small room, there was one bed used by the deceased and the children, the man slept on the floor near the door. When the husband awakened in the morning he left the room to smoke outside, without noticing anything unusual, after a time he called to his wife to bring him something, getting no reply, went into the room, and saw her hanging. Neither the man nor the children heard any noise, though sleeping within a few feet.

In all works on Medical Jurisprudence instances of death due to partial suspension are described. The following case occurred in 1901 :—The police report states the deceased aged 60 to 65 years, had been ill for some time. On the morning of the 3rd February, his nephew found the door of his room fastened, and getting no answer to his repeated knocks, forced open the door. On entering, he discovered his uncle dead in a sitting posture, leaning forward, round the neck there was a noose of string, the end being fastened to a shelf about 4 feet high. I made the post-mortem examination on the same day, the body was very emaciated, there was advanced chronic lung disease. Round the neck there was a noose of thin string and on the neck a corresponding mark, the internal appearances showed that death was due to asphyxia, there were no marks of violence on the body. The string forming the noose was thin and broke at a moderate strain, it certainly was not of sufficient strength to support the whole weight of even the emaciated body of the deceased.

Dixon Mann in his Forensic Medicine and Toxicology, quotes several cases of partial suspension ; one, from the the *Lancet,* refers to a man who tied the ends of his handkerchief together, to make a loop which he put over the handle of a door 2 feet 9 inches from the floor, he then sat down, put his head through the loop and bent forwards, the texture of the cloth was plainly impressed on the neck. Another instance, from the same work, is more extraordinary, a woman hanged herself with a rope which she fastened to the leg of a table 17 inches from the floor.

Partial suspension and suspension in an unusual manner point to suicide, a murderer would not use partial suspension to kill his victim, though he might, having committed the murder by other means, employ it to give an appearance of suicide to the case.

In India suicide is common, and one of the means most frequently resorted to is hanging ; this is known to every one and consequently when a corpse is found suspended, the natural view to take is that the deceased hanged himself, the presumption of suicide is very strong, hence murderers have attempted to conceal their crime by suspending the corpse of their victim. The difficulty of determining that death was due to suspension during life has been referred to ; the discovery that the case is one of suspension after death, can only be effected by careful and complete post-mortem examination. In many of the cases of homicide in which the corpse has been suspended, death was caused by asphyxia due to strangulation, pressure on the chest, or closure of the mouth and nostrils, consequently the general internal appearances may be the same as those found in death by hanging, and the nature of the case will only be revealed by a careful and minute examination. Fortunately for the ends of justice, the murderer has not the knowledge, nor the calm deliberation to avoid using unnecessary violence, consequently marks of injury are found on the body which declare the character of the act. In dealing with a case of alleged hanging, it is well to recollect that, as a rule, in suicide, the tissues of the neck show no sign of injury and therefore where injuries are found, the case should be viewed with suspicion and subjected to close scrutiny.

The presence of a poison in the stomach, in a case of hanging, does not negative suicide, the following is an example :—When examining a case of hanging, the contents of the stomach were found to give off a strong smell of opium, the post-mortem appearances of poisoning by opium are those of asphyxia, the mark of suspension on the neck was of the usual kind, and there were no signs of violence on the body. The circumstances of the case pointed to suicide ; the deceased a woman of about 50 years of age, had been greatly depressed in mind, owing to her paramour who had lived with her for twenty years, having taken up with a young woman, and had been heard to say she was tired of life. She was found hanging in her own room, the door closed from inside. The Chemical Examiner found a marked quantity of opium in the viscera.

Unquestionably it would not be difficult to suspend an unconscious person and if an odourless, colourless narcotic had been used, for example morphine, unless the circumstances were such as to give rise to suspicion, the case would be accepted as one of suicide by hanging.

Injuries on the body do not, necessarily, negative suicide, they may be due to accident before hanging, or to attempted suicide by other means. Several instances of the latter kind are recorded, people have attempted suicide by cut-throat, gunshot, and other ways, failing, have hanged themselves.

Injuries may be caused by breaking of the rope, or by falling, when suspended, against a hard object.

The medical jurist must examine and carefully consider the position, character and probable effects of injuries on the body, also whether they are of ante or of post-mortem origin.

The body of a young man was discovered on the side of a tank, the legs in the water, round the neck a noose of coir rope, the end was frayed. Above the body, there was a tree, to a branch of which a piece of coir rope was fastened, the end was frayed. The mark on the neck corresponded to the coir noose, the internal appearances were those of asphyxia ; the spleen which was very large, was ruptured in three places but only a very small quantity of blood was found in the peritoneal cavity. No doubt the coir rope broke after death and the rupture of the spleen was post-mortem.

The following case is of great interest, it occurred in February 1901, and is not included in the 128 cases previously mentioned.

The police report and the evidence of the principal witnesses at the inquest were as follows :—The deceased, a youth of 16 years, was in the habit of visiting a prostitute, named Soshi, who finding he had no money, refused to receive him any longer. On the 30th January, he went to her house in the evening, she turned him out, he left in a rage, saying he would take his own life. He returned about midnight and as he was in a quarrelsome mood, Soshi gave him some milk and betel. After a time, he went to answer a call of nature, Soshi walked down stairs with him to point out the place. While he was in the latrine, she went to the room of another prostitute, and told her about the youth, his bad temper and threats. While the women were talking, the youth went upstairs. Soshi followed within a few minutes, and on entering her room, saw the youth hanging by a cloth round his neck, the end fastened to one of the bamboo beams. She raised an alarm, the other prostitute and a man who had a shop downstairs came, they opened the noose, the youth fell on the floor and began to struggle and shout.

The police were sent for and carried the youth down the stairs, put him into a gharry and took him to the Mayo Hospital. He was struggling and shouting the whole time, but did not speak. From the evidence it would appear that he was conscious, though unable to speak; one witness said, she could see he understood what was said and done, and that he resisted being taken downstairs and put into the gharry. At the Hospital he was violent, throwing himself about and shouting, but did not speak. His stomach was washed out. According to the statements of the witnesses, the suspension took place between 2-15 and 2-30 A.M.; he was admitted to Hospital at 3-45 A.M. and died at 7-15 A.M.

The post-mortem examination was held on the 1st February, 24 hours after death. Rigor mortis present, there was a bunch of fine lathery froth about the nostrils; this was not present when I viewed the body the previous evening. There were several small bruises and abrasions on both sides of the neck, the largest about half an inch in diameter. Small bruises and abrasions were also present on the arms and back of the left hand. There was no sign of a noose mark on the neck. From the position and character of the injuries, it seems probable that they were caused in bringing deceased downstairs, in the gharry and at the Hospital, in endeavouring to hold him.

The condition of the lungs was most interesting and unusual; all over both, there were numerous subpleural hæmorrhages, some petechial, others splashes of considerable size. In both apices and anterior surfaces, there were patches of miliary emphysema, the lungs were very congested and filled with watery fluid, the trachea and bronchi were full of froth.

The front of the heart was sprinkled with small hæmorrhages, which were also present on the back of the left ventricle. Both sides of the heart were filled with dark fluid blood.

The trachea was congested, there were petechiæ on the back of the epiglottis. The tongue was normal. The internal organs were congested. The viscera were sent for analysis, no poison was found.

Having heard the evidence of the principal witnesses, the two women and the shopkeeper, and of the House Surgeon, in reply to the Coroner I gave the opinion that deceased had died of asphyxia or suffocation, due to hanging.

The case is one which, without the evidence of the eye-witnesses and of the House Surgeon, would, in all probability, be considered one of asphyxia or suffocation due to throttling, or to smothering with a cloth held over the face ; the injuries, bruises and abrasions on the face, neck and other parts of the body would have been held to be indubitable signs of homicidal violence. From the pathological point of view, the interesting feature of the case is the occurrence of capillary hœmorrhages in so marked a degree, on the lungs and heart. The experience of suicidal hanging shows that subpleural and subpericardial hæmorrhages are very rare, not in one of the 128 cases examined up to November 1900, it may be pointed out that among them, there were two instances of girls being cut down alive, though they died soon after. The hæmorrhages in the present case were probably connected with the violent muscular movements exhibited by the deceased when noose was opened and he fell on the floor. Though it is not stated by the witnesses, it is possible that the movements they saw were the result of convulsions, and as mentioned in a previous page, experiments on animals support the view that capillary hæmorrhages occur in asphyxia during the period of violent expiratory efforts, and that they are absent in cases in which convulsions have not occurred. In the two girls, who were cut down alive and died shortly after, there were no capillary hæmorrhages, and in the history of the cases, there is no mention of any movements of a convulsive character.

These three cases, especially that of the youth, show that when cut down alive, even though life continues for some hours, the effects of hanging are so grave that death follows.

Homicidal Hanging.

There is no sign in hanging which distinguishes a suicidal from a homicidal or accidental case ; the distinction must be made by a consideration of the circumstances and of the marks of injury found on the body. To hang an adult, unless unconscious, would be an extremely difficult task, and the body of the victim would, without doubt, present such marks of violence as would establish the character of the case, unless, as in the instance which occurred in Paris in 1888, the murderers were able to take their victim unawares, and to suspend him before he had time to realize what was being done. In the case referred to, the murderers were a woman, named Bompard, and a man of the name of Eyraud. The victim was a man, named Gouffé, he had been in the habit of visiting Bompard. On the day of the murder, Bompard sat on a sofa, placed in front of a curtained alcove, with the woman on his knee; in a playful way she slipped a noose of silken cord over his head and passed the end to her accomplice who was concealed in the alcove. Before Gouffé arrived, the murderers had made their preparations, Eyraud fixed, to the top of the alcove, a compound pulley provided with a strong rope on which there was a hook. When Bompard passed the end of the noose to Eyraud, he slipped the loop over the hook and hoisted up Gouffé.

Cases of this kind are very exceptional and unless the circumstances, or one of the murderers, declare the character of the act, the medical jurist cannot distinguish it from a suicide.

Children, weak, feeble adults and persons rendered helpless by drugging or intoxication have been killed by hanging, but even in such cases, considerable difficulty would, under ordinary circumstances, be experienced in carrying out the suspension, consequently homicidal hanging is very rare.

JUDICIAL HANGING.

Captain Oldham, I.M.S., has kindly placed at my disposal particulars of the lesions found in the necks of 10 criminals hanged in the Presidency Jail. The following account copied from Captain Oldham's report may be taken as typical of all the cases; such differences as were found, were slight—" Ramrup Teli executed 6 A.M. 5th September 1898—height 5ft. $5\frac{7}{8}$inches—height to neck 4ft. 10inches—weight 117lbs.—drop allowed 6ft., the actual drop as measured after death was 6ft. 4inches. There was no movement after the drop and death appeared to be instantaneous.

Post-mortem examination at 8 A.M. Ligature mark all round the neck, slight seminal staining on the thighs, no protrusion of the tongue or of the eyes, no engorgement of the superficial veins or of the eyes. Expression natural, tip of the tongue bitten. Deep veins of the neck distended and fully engorged. Bruising of the right sterno-mastoid, severe bruising of deep muscles on both sides of the neck. No muscle or vein torn. Fracture of the anterior inferior tip of the thyroid on the left side, and of the cricoid on the right side, fracture of hyoid bone, about the middle on the left side, and near the tip of the cornua on the right side. The second vertebra was completely separated from the third, the inter-vertebral cartilage was adherent to the second vertebra and intact. The tip of the articular process of the third vertebra was broken off on the right side. The spinal cord was torn completely across and all its membranes torn through, it protruded an inch from the lower portion of the broken column. Death instantaneous."

CHAPTER VII.

STRANGULATION.

STRANGULATION is produced by compression of the neck by means of a ligature, which is tightened by a force other than the weight of the body ; usually the ligature is drawn tight by pulling on the ends, crossed at the back of the neck, or several folds of the ligature may be wound round the neck tightly and the ends knotted, or a loop of rope is thrown over the head, a stick inserted beneath it and twisted, by which the noose is drawn tight.

The garrotters, coming behind the victim, threw a loop of rope over the head and pulled backwards and upwards, the resulting mark on the neck was oblique like that of hanging.

Thugs, in India, generally used a handkerchief which they threw over the head of their unsuspecting victim, crossed their hands and gave the neck a sudden sharp wrench, which, it is said, not infrequently caused dislocation.

The Spanish mode of executing criminals by the garotte is carried out in the following manner :—

The condemned stands against a post, his neck is encircled by an iron band or collar, which can be drawn tight rapidly by the action of a screw.

In strangulation death is due to closure of the air passage and compression of the vessels and nerves, as in hanging, and loss of consciousness is immediate.

POST-MORTEM APPEARANCES.—The most important sign of strangulation is the mark on the neck ; it varies greatly in appearance, in many cases it resembles the mark found in suicidal hanging, differing only in position, direction and completeness ; in other instances and especially among children and young persons it exhibits signs which unmistakably proclaim its character.

The different appearances presented by the mark depend upon the condition of the tissues of the neck ; the soft skin and delicate structures of a child exhibit far greater signs of injury than the tougher tissues of an adult; upon the kind of ligature used ; and especially upon the amount of force applied.

Strangulation is generally homicidal. When a corpse is discovered with a strangulation mark on the neck, the presumption of homicide is strong. Cases of accidental and of suicidal strangulation are rare.

In order to study the appearances of the neck in strangulation, a case of homicide in which the victim was a child or a young person, the murderer a man, and the ligature used was a rope, will first be described. The neck will exhibit the following appearances : On the lower part or over the larynx, a furrow horizontal and encircling the neck completely ; behind, the ends of the furrow may overlap, owing to the crossing of the hands in tightening the rope, or at the back of the neck there may be a broad irregular mark due to the pressure of the knuckles of the assailant. The direction of the mark will generally be horizontal, but it may be oblique, if the person strangled was sitting and the murderer standing behind the force would be exerted in an upward and backward direction, producing an oblique mark. The size of the furrow will depend on the size of the ligature used ; its surface, if examined early, that is, soon after death, will be soft, moist, exuding blood, or blood stained serum ; examined later it will be dry, hard, parchment-like, the colour may be yellowish brown, or reddish from patches of extravasated blood which, if present, will be mostly in the front of the neck.

Having dissected off the skin, which should be done carefully to avoid opening veins, the tissues beneath the mark will present signs of injury, often considerable, there will be scattered patches of blood extravasation, not only immediately beneath the skin, but also between the muscles, in the sheaths of the carotid vessels and in the muscles. Severer injuries are also met with, rupture of muscles, fracture of the larynx, or of rings of the trachea, and even dislocation of the spine may be found. The tissues of the neck beneath the ligature may be filled with extravasated blood and present the appearance of extensive and severe bruising.

The face is generally swollen, cyanosed and dotted over, especially the eyelids and surrounding parts, with petechial hæmorrhages which are also found in the neck above the ligature mark. The eyes are swollen, prominent, the conjunctivæ ecchymosed; there is, frequently, bleeding from the eyes, ears and nose. The tongue is protruding, bitten by the teeth, and there is blood stained froth about the mouth and nostrils.

If the victim was a young person marks of a struggle and signs of injury may be found on the body, but not in the case of children or if the person was taken unawares.

The internal appearances are those of death by asphyxia, dark fluid blood, distention of the pulmonary artery, the right side of the heart and venous system ; the lungs congested, sub-pleural and sub-pericardial ecchymoses, larger hæmorrhages in the lungs and patches of emphysema. In the air passage bloody froth ; capillary hæmorrhages, or larger patches of extravasation in the mucous membrane of the larynx and trachea.

The brain is congested, the vessels of the head are greatly distended.

The above description applies to strangulation in which great violence was used, especially when the victim was a child or young person.

In adults the appearances are much less marked. the neck presents a furrow, generally at the lower part, horizontal, and continuous, its surface will generally be dry, hard and parchment-like at the time of examination, the colour yellowish brown with scattered patches of red, due to extravasation of blood. They are usually small and frequently absent, so that the surface has the appearance of the mark in hanging. In the tissues of the neck extravasations of blood may be found, they are generally small and may be altogether absent. It cannot be too clearly realized that in strangulation the neck may present only a mark similar to that found in hanging, from which it differs in position and direction, and that extravasations and injuries of the tissues of the neck are, in the case of adults, usually slight and may be altogether absent. When strangulation is effected by a cloth, the mark on the neck will be a broad shallow impression, the cuticle uninjured and no extravasation of blood in the skin or in the tissues, of the neck ; of course a hard tightly twisted cloth will produce the effect of rope. But if a soft thick cloth be used and removed immediately after death, no sign of the strangulation will be perceptible at the time of the post-mortem examination, though at first a faint impression may have been present.

A case of this kind is beyond the skill of the medical jurist, its nature can only be determined by the circumstances, he can state to the Court that the post-mortem examination showed that death occurred by asphyxia and that he is unable to discover the cause. Of course the viscera must be examined and the result made known to the medical jurist before he gives his opinion. During the eight years I held the appointment of Police Surgeon in Calcutta I met with a considerable number of cases of death by asphyxia for which I could discover no cause ; in some of them the circumstances were suspicious, pointing to homicide, but nothing in the way of reliable evidence could be obtained.

The internal appearances in strangulation of an adult are those of asphyxia, sub-pleural and sub-pericardial hæmorrhages may be present but are more often absent.

Having concluded that death was due to strangulation, the medical jurist has next to determine whether it was the result of accident, suicide or homicide ; most cases of strangulation are homicidal, it is not a mode of death often selected for self destruction and cases of an accidental character are very rare and usually easily recognised. Instances of accidental strangulation are quoted in most works on medical jurisprudence. Taylor mentions the case of an armless man who was in the habit of carrying a weight by means of a noose round his neck, the weight slipped to the back and the noose compressed his throat. Another recorded case is that of a girl who, while carrying a basket of fish on her back supported by a strap which passed across her chest, rested the basket on a wall from which it tumbled to the other side, the strap slipped up and compressed her throat.

SUICIDAL STRANGULATION.

There are many cases of suicidal strangulation on record ; still it is a mode of self-destruction seldom selected and when a corpse exhibits signs of strangulation, the presumption of homicide is strong and the evidence of the suicidal character of the act must be closely sifted. The medical jurist, in a case of this kind, will be greatly assisted if he has the opportunity of seeing the body before it has been disturbed or removed from the place it was discovered ; he should observe the surroundings carefully, the condition of the room, the posture of the body, the position and state of the hands, the appearance of the face ; and obtain from the police or from the people of the house a statement of all the facts as far as known, the time the deceased was last seen alive, the hour his death was discovered, and he should inquire particularly whether the noose round the neck had been disturbed ; in the morgue a careful examination must be made, the condition of the face, all marks of injury noted ; the most important factor in coming to a decision as to the nature of the case is the noose on neck, its character and position, the number of turns round the neck, if tied the position and kind of knot and the number of knots.

Several turns of the ligature round the neck do not negative suicide, Maschka considers they point to suicide. A number of turns of the ligature round the neck is neither for nor against suicide, the inference to be drawn depends on the way they are put on, if the external turns are loose and those first applied tight the inference is that the case is one of homicide, for the first put on tight turn would, in all probability, produce immediate loss of consciousness ; a ligature placed loosely round the neck several times and the last turn drawn tight and knotted would be compatible with suicide. In estimating the degree of tightness of the ligature and its effects, allowance should be made for swelling of the tissues after the application of the ligature. A suicide in winding a ligature round his neck would probably compress the windpipe and the veins, but it is likely that the circulation through the carotids would not be completely stopped, and consequently there would be an excess of blood in the head which would cause swelling of the tissues. It is difficult otherwise to account for the presence of several tight folds of ligature round the neck in undoubted cases of suicide.

In some recorded cases loops of cloth or rope, placed round the neck, have been tightened by inserting a stick through the loop and twisting it.

The kind, number, and position of the knots on the ligature are of great importance, and may be distinctive, several well-made knots on different turns of the ligature point to homicide ; but a suicide, after encircling his neck with several turns of a ligature, may be able to fasten the ends with a well-made knot. The following case from Hofmann illustrates this point. It was an undoubted case of suicidal strangulation. A girl was found dead, round the neck there were three turns of string tied in front with a double knot ; the string was so tight that the skin bulged above its edges, and a blade of a knife could with difficulty be inserted beneath it. The face was cyanosed and swollen, the site of the ligature and the tissues of the neck were also cyanosed, the eyelids were swollen and sprinkled with punctiform ecchymoses, the conjunctivæ injected and ecchymosed. The mark of the ligature was below the larynx, it was partly pale, partly parchment-like ; there were numerous ecchymoses in the tissues of the neck, beneath the skin, between the muscles, slight bruising of the sterno-hyoid muscles and lower edge of the thyroid cartilage ; the front of thyroid cartilage was bent slightly inwards. There were ecchymoses in the adventitia of the carotids, in the mucous membrane of the throat and in the scalp ; the brain and its membranes were congested.

Another case, described by Hofmann, is most instructive :—The deceased woman was found lying dead on the floor of her beerhouse ; the body lay on the back and was half clothed, in the mouth there was a gag made of a napkin. Round the neck there was a silk cloth, the ends knotted ; on removing it, a string was found wound twice horizontally round the neck, knotted over the larynx, the dependent ends formed into a sling. The face was swollen and cyanosed ; there was bleeding from the ears, ecchymoses on face ; on the neck a pale furrow, above its edge, on the left side, a dry brown-red spot, near the latter a similar spot surrounded by suffusion ; on the right side, at the lower edge of the furrow, there were a patch of a violet red colour and a row of small vesicles. The scalp was cyanosed and ecchymosed ; there were ecchymoses in the temporal muscles. There was no extravasation in the floor of the furrow, but in the sheath of the sterno-mastoid a small extravasation. There was bloody slime in the pharynx and larynx, the mucous membrane of which was of a violet grey colour, the lungs were congested ; there were ecchymoses on the heart.

A letter was found in the handwriting of the deceased which placed the nature of the case beyond doubt.

These two cases are of great medico-legal interest ; in both the suicidal character of the strangulation was placed beyond doubt by the circumstances, and as regards the second woman there was also the letter in her handwriting ; yet the post-mortem appearances in both pointed to homicide, the cyanosed swollen state of the face, the condition of the skin and tissues of the neck, the manner in which the ligatures were applied ; in the second case the gag in the mouth ; in fact, all the post-mortem appearances pointed to homicide ; moreover the deceased were women. The absence of signs of a struggle does not negative homicide ; there are many recorded instances of strong men, taken unawares, being strangled without making the slightest resistance.

A study of these two cases shows the importance, to a medical jurist, of a full and complete account of all the circumstances of every case of death by violence which he may be called upon to investigate. There can be little doubt that in the above-quoted cases, had they occurred in India where the medical jurist has frequently to base his opinion on the post-mortem appearances alone, the conclusion come to, would have been that they were homicidal, and it might easily happen that innocent persons would have had to stand their trial for the supposed murders.

The cases are undoubtedly exceptional, and they do not alter the correctness of the long-stablished belief that death by strangulation is usually homicidal. I have had the opportunity of examining one case of strangulation which, in my opinion, was suicidal :— The deceased, an oil-seller, had rented a small room in a tiled hut for two days ; he was last seen alive on the 19th March 1894 about 4-30 P.M., hawking oil. On the evening of the 20th idem, the attention of the occupants of the adjoining room was drawn to his room by a bad smell coming from it. They knocked at the door which was closed but got no answer. The police were informed ; they came, and forced open the door which was fastened from within, the deceased was found on the floor covered with a sheet. He was lying on his left side, the legs drawn up and flexed. Round the neck and legs, there was a rope which was not disturbed by the police. The body was removed to the morgue where the post-mortem examination was held on the morning of the 21st.

The body was swollen from putrefaction and exhaled an offensive odour ; the cuticle was loosened generally and there were maggots on the waist-cloth. There was a rope around the neck and legs, put on in the following manner :—On the neck, there were two turns forming a clove hitch, beneath which one end of the rope was inserted ; the other end passed down over the front of the body and behind the left thigh, and was wound twice around the legs below the knees, being fastened by being doubled and slipped beneath the turns.

When the rope was removed a double furrow was found encircling the neck horizontally and completely, the surface was, in places, dry, hard and parchment-like, in parts moist ; the tissues beneath showed no sign of injury, and were slightly condensed. There were no hæmorrhages on the face, neck or elsewhere ; the features were swollen from putrefaction. The internal appearances were those of asphyxia. There were no signs of injury on the body.

I gave the opinion that deceased died of asphyxia caused by self-strangulation.

In 1899 the opportunity occurred of examining the neck of a woman who had tried to strangle herself but had been rescued. She was insane and was known to have a suicidal tendency and was carefully watched ; one morning, while sitting in a room, she got up quietly and went into the verandah. Her attendant followed in a very short time, estimated to be half a minute, and found her standing in the verandah pulling the ends of a rope noose which she had placed round her neck. The attendant seized her and removed the rope, the woman's face was bluish red and the veins of the neck were distended. She was not in the least unconscious, and within a short time her face resumed its normal hue. I saw her in the afternoon ; on her neck there was a red, excoriated mark which was slightly swollen and very tender to the touch, it passed round the neck horizontally and was very faint behind. It is evident that the woman used considerable force ; the mark was visible for days.

In some of the recorded cases of rescue from hanging and strangulation, a comatose condition was observed for hours or days, ending in death or in recovery ; in other instances, symptoms of mental disorder, usually lasting a few days but sometimes persistent, have occurred ; convulsions have frequently been noted in these cases.

HOMICIDAL STRANGULATION.

It is probable that at one time in India more people were murdered by strangulation than by any other means ; the Thugs seldom used any other method, and, it is said, became so expert that the victim was killed without making any attempt at resistance. They made their plans and carried them out with as little feeling and excitement as the butcher in the slaughter of animals. The victim was taken unawares, the noose thrown over his head, the neck suddenly and forcibly compressed ; death was immediate, and the only mark on the body was that of the noose on the neck. In the present day professional stranglers, as the Thugs may be termed, are not met with, and homicidal strangulation is the act of an individual who, from motives of revenge or cupidity, or to get rid of an enemy or of an infant, adopts this means. If the victim is an adult, it is probable that, though taken unawares, the murderer has not the skill to cause immediate loss of consciousness, and a struggle ensues, signs of which will be found on the body. Moreover the murderer, at the time, is in a state of great excitement and uses unnecessary violence on the neck and other parts of the body of his victim. Finger marks on the throat, bruises on the face, cuts on the lips from pressure against the teeth, bruises on the chest and fracture of ribs produced by the murderer kneeling on the chest, have been found ; injuries of this description place the character of the case beyond doubt. More often the signs of injury are less, consisting of bruises on different parts of the body and face, but even slight injuries may, from their position, serve to determine the nature of the act. In examining a case of strangulation careful note should be made of the position and character of every sign of injury found on the body, every mark should be dissected, external inspection may give a very erroneous idea of the extent and degree of an injury.

When strangulation is effected with a soft cloth, such as a muslin saree or chudder, loosely folded, the mark on the neck will be broad, faint, and only slightly depressed ; on the back of the neck, it may be altogether absent ; the surface is soft, there is no abrasion of the cuticle and no extravasations of blood either in the skin or in the tissues of the neck. The mark exhibits no signs of vital origin and presents appearances exactly the same as those found in hanging when the suspensory medium has been a soft cloth, the direction only is different. Moreover, if the cloth was removed immediately after death, there will probably be no mark visible when the body is examined, if the post mortem is held several hours after death. In the chapter on hanging, mention is made of the case of a girl cut down alive and on whose neck a competent observer saw a mark which had almost disappeared at the time of the post-mortem examination.

When strangulation is effected with a noose of rope applied with great force, the neck exhibits injuries which are evidently of ante-mortem origin, the blood extravasations in the skin and tissues of the neck are the result of the rupture of vessels during life. If a large, soft cloth is drawn tightly around the neck, the structures are compressed and death follows quickly, probably as rapidly as when the noose is of rope, but though it compresses, the cloth does not rupture the blood vessels nor abrade the cuticle, consequently no extravasations of blood take place and the mark exhibits no sign of vital origin, in this it resembles the mark in hanging ; if the cloth is removed immediately after death, the tissues released from the compression and still retaining their elasticity quickly expand and all trace of the mark is lost.

It is evident that in a case of this kind the proof that death was due to strangulation would depend on the evidence of eye-witnesses, the medical jurist could only testify that death resulted from asphyxia, and that the absence of the usual mark on the neck is compatible with strangulation.

The following case of self-strangulation was examined in March 1903 :—At about 9-45 A.M., on the 9th, the body of a man, supposed to be a Eurasian, was discovered in the ladies retiring room at the Royal Botanic Garden, Sibpur, by the jemadar chuprassi whose duty it is to inspect the room daily. Information was sent to the police, and the darogah of the Sibpur Thana investigated the case. The body had not been disturbed when he arrived ; he found the deceased lying on the floor on his face, the body was partly on the left side, the arms under the chest. On the floor beneath the face there was blood, forming a patch about 4 inches in diameter ; there was blood about the nostrils. The left side of the face, which was dependent, was of a darker colour than the right ; the eyes and mouth were closed. The tongue was not protruding. Round the neck there was a portion of a handkerchief, twisted into rope shape, forming a noose tied in front by a single simple knot, one end of the noose was touching the blood the floor, The noose was drawn tightly, and when removed a furrow was seen on the neck.

The room was about 12 feet square, and contained a table and two commodes ; there was a hat on the table, and a razor case on one of the commodes ; in the other commode there were fæces and a portion of handkerchief which, when compared with the noose, was found to correspond. On the floor, near the body, on the left side, there was an open razor.

I held the post-mortem examination at 10-30 A.M. of the next day The body was beginning to putrefy, the face was swollen, and of a dark colour. Round the neck there was a noose mark, it encircled the neck completely ; behind, at the margin of the hair, it was 1¼ inches broad, passing forwards it narrowed gradually and in front was half an inch wide. The mark was slightly depressed, the surface pale and soft, except in front at the site of the knot, where there was a small patch of parchment-like consistence, The tissues beneath were condensed ; there were no extravasations in any of the tissues of the neck, nor signs of injury.

Close to the noose mark on the front of the neck, over the thyroid cartilage, there was a small bruise in the skin, three-quarters of an inch in diameter, and immediately above it, two short transverse cuts into but not through the skin; they were about one inch long and parallel to each other.

The internal appearances showed that death was due to asphyxia. There were no petechial hæmorrhages or extravasations in the lungs, larynx or elsewhere.

The body, subsequent to the post-mortem examination, was identified as that of a Parsee student of the Engineering College, who, a day or two before his death, had been arrested in one of the disreputable streets of Calcutta at night, for riding a bicycle without a light, and fined by the Police magistrate. The circumstances proved beyond doubt that the case was suicidal.

CHAPTER VIII.

THROTTLING.

STRANGULATION effected by compression of the throat with the hand is called Throttling. Death is due to closure of the air passage, compression of the vessels and nerves. Loss of consciousness takes place immediately.

When the throat is grasped, the pressure of the fingers on the sides closes the rima glottis, and at the same time, the pressure of the palm of the hand against the front of the throat pushes the root of the tongue backwards against the posterior wall of the pharynx. The fingers also compress the vessels and nerves.

In some cases of throttling, death has occurred instantaneously, probably from cardio-respiratory inhibition; it is well known that death may take place suddenly without convulsions from violence, even though slight, applied to certain parts of the body. The larynx is one of these situations, and there are cases of sudden death following a slight blow on it; the following case is recorded by Brouardel. An Abbé was compelled to part with his mistress; they were both greatly depressed. He said to her, we should be happier if we were dead. "Yes," said she, "if we could die together." The Abbé said, jokingly, "Could you bear me to cause you much pain," "Try," she replied. He took hold of her neck, it was intended as a harmless piece of fun, and she showed by a smile that she regarded it as such. All at once she made a sign of pain and shook her hands, but without uttering any cry. He relaxed the pressure and she fell down dead.

The medical jurists called at the trial neither accepted nor rejected the account given by the Abbé. During the hearing of the case, an officer made the following statement : " Some officers were in a room together, one in a playful manner said to another, " Now, old fellow, I am going to put you out of the way," and seized him by the neck. The officer whose neck was seized, staggered and fell in a state of unconsciousness ; under skilful treatment he soon recovered."

Hofmann describes the case of a woman who was thrown down, seized by the throat and robbed, she remained senseless for some time. On recovering she stated she recollected being thrown down and having her throat seized, but from that moment felt nothing, neither suffocation nor pain.

These cases show that from slight violence on the throat, loss of consciousness and even death may immediately result ; the explanation of the fatal consequence of such slight violence is, at present, held to be cardio-respiratory inhibition. The post-mortem appearances are not characteristic ; Brown-Séquard states that the venous blood remains red for a very long time without turning black, and that the temperature of the corpse falls very rapidly. Even if constant, these two signs are not sufficient for medico-legal purposes ; and if called upon to examine and to give an opinion on a case of this description the medical jurist, having examined the body and heard an account of the circumstances, can only place before the court the fact that cases of a similar kind are recorded.

Cases of the above-described type are very rare ; as a rule in throttling well-marked signs are found and death occurs by asphyxia. Throttling is homicidal ; there is on record one case which by some authorities is held, I consider incorrectly, to be an instance of suicide by throttling, a lunatic who had previously attempted to throttle herself, succeeded in the following way :—She was found dead in bed in a sitting posture, both hands grasping her throat, the elbows resting on the drawn-up knees, the head fallen forward. In this case, death was mainly due to the posture. When loss of consciousness occurred from the pressure of her hands on her throat, the weight of the head kept the air passage closed after the grip of the fingers had relaxed. Except under special circumstances, such as in the instance mentioned, suicide by throttling is hardly possible ; no doubt a person can by grasping his throat produce unconsciousness but when this occurs the grip of the fingers relaxes and respiration returns.

In India throttling is a common mode of homicide, the victims are generally children or women. The most important signs are found on the neck ; most people are right-handed, and the right hand being used to grasp the victim's throat, the following appearances are found :—On the left side the marks of the fingers, on the right side that produced by the thumb. In a typical case, the left side of the throat exhibits the marks of the four fingers, arranged one below the other obliquely, from above downwards and outwards. The position depends on the size of the hand and of the neck. A large hand reaches far back, or if the neck be small a hand of small size will make marks far back. The mark produced by the thumb is usually larger than the finger marks, and it is also generally more distinct and exhibits signs of the greater power of the thumb.

The marks are abrasions, blood-stained, moist, if seen soon, dry, hard, yellowish-red, parchment-like, if examined when dried by evaporation. Crescentic cuts produced by the nails may be found on the surface, but not often in India, where the custom of keeping the nails short is general. The surface is rough, and in recent cases, has a red raw appearance. The size varies not only because of the different sizes of fingers, but especially if, as will generally happen except in children, the fingers move during the act of throttling. The number of marks may correspond with the number of the fingers, or may be fewer, owing to one or more of the fingers not coming into forcible contact with the neck, or there may be many marks produced by changing the position of the grip or by the use of both hands.

In the subcutaneous tissues beneath the marks, extravasations of blood are found, also between the muscles, in the sheaths of the vessels, and in the mucous membrance of the larynx ; fractures of the thyroid cartilage or of the hyoid bone are frequently met with. The injury to the deeper structures of the neck may be very great.

In addition to the marks on the neck, signs of violence are commonly present in other parts of the body. The face is usually swollen and cyanosed, there is bleeding from the eyes, ears, and nose. The eyes are protruding and ecchymosed, the tongue may be protruding and bitten by the teeth. Bruises are commonly found on the face, about the mouth ; the lips may be cut by pressure against the teeth caused by the left hand of the murderer in endeavouring to prevent the deceased from crying out. Bruises on the chest and fracture of the ribs are also not uncommon, the result of kneeling or sitting on the chest.

But, even in the case of a strong adult, all signs of a struggle may be absent, by his having been surprised and quickly rendered unconscious by the firm grasp of the murderer on the throat.

In children the marks are usually far back, but the tissues being delicate the whole front of the throat may be bruised by the pressure of the palm.

The internal appearances are those of asphyxia ; sub-pleural and sub-pericardial ecchymoses are rare, except in children.

The following is a typical case of throttling.—Baroda, aged about 24 years, a prostitute, was last seen alive at about 10 P.M. About 11 P.M. she was heard talking in her room, and in answer to a question, said she was entertaining a man she knew. About 5 A.M. she was found dead on her bed, there were blood stains on her ears, face and nostrils, a portion of her saree was stuffed into her mouth ; a small empty phial and an empty liquor bottle were close to the bed, several ornaments were missing, which she had been in the habit of wearing.

I held the post-mortem examination at 2-30 P.M., about 9½ hours after the body was discovered.

The body was well-nourished, rigor mortis present, the clothing consisted of a saree, a portion of which was stuffed into the mouth, this part of it was blood-stained. On the right forearm there were three silver bangles, one of which was tightly fixed over the base of the thumb, evidently an attempt had been made to remove it.

The eyes were swollen and bloodshot ; there was blood on the edges of the lids and on the eyelashes, and stains of blood about the nostrils and in the auditory meatus on both sides. The right side of the face was swollen; on the inner surface of the lower lip, on the left side, there was a small cut about $\frac{1}{12}$ of an inch long, evidently caused by pressure of the lip against the teeth, the mouth was open to the extent of about one-third of an inch, the tongue was pressed back into the floor of the mouth and its surface presented a depression due to pressure of the cloth.

There were two small abrasions on the back of the left hand. The signs of throttling were unusually distinct. On the right side of the neck there were four marks arranged obliquely from above downwards, the highest being nearest the middle line, it was also the smallest, and was on a level with the hyoid bone. On the left side there was one mark, about an inch and half wide, and longer than the marks on the right side. It was directed obliquely, the inner and higher end, was opposite the hyoid bone. The marks on the right side were of different sizes, the largest was the third from the top and was about an inch long and half an inch wide; the fourth was the smallest. The surface of all the marks was dry, hard and parchment-like, and beneath all there was extravasated blood but not in large amount. In the mucous membrane of the left side of the pharynx, there was an effusion of blood and some small extravasations in the larynx. There were no fractures of the cartilages and no effusions in the deeper structures of the neck.

The lungs were congested; along the anterior surface of the left lung, there were a few small areas of sub-pleural emphysema. There were no sub-pleural or sub-pericardial ecchymoses. The internal organs exhibited the signs of death by asphyxia. The scalp and brain were markedly congested. No poison was found on analysis of the viscera.

The murderer evidently throttled with his left hand, while with the right he pushed the cloth into the woman's mouth to prevent her calling out.

In another case which occurred in 1888, Dr. Mackenzie found the following appearances, the deceased was a woman, aged about 65 years. On the front of the throat, there were, on the left side, four marks about the size of an eight anna piece, and on the right side below the jaw one similar mark. The skin of the marks was ecchymosed, there were extravasations of blood in the subcutaneous tissues and in the substance of the muscles, beneath the marks. There was a fracture of the body of the hyoid bone, and of the cornua of the thyroid cartilage and of the body of the cricoid cartilage. There were contusions on the lower lip, right cheek, forehead and bridge of the nose. There was also a contusion on the right wrist, and abrasions on the front of the abdomen and right thigh. The tongue was protruding, the lungs and internal organs were congested, the blood dark and fluid.

It is rare in cases of throttling to find such typical finger marks as were present in the above quoted cases. What is generally found on the neck, is, on one side, usually the left, a large irregular shaped abraded surface, and on the other side a similar but smaller mark. In many cases of throttling, a cloth is thrown over the victim's head and the throat is gripped through the folds ; if the cloth is thick, it protects the skin, and little or no external sign of injury is produced. The following case illustrates this point. An old woman, last seen alive at 6 P.M., was discovered dead at 7 A. M. next morning, on her bed, with her head and neck enveloped in two pieces of cloth which were knotted in front. I held the post-mortem examination on the same day at 4-15 P.M. The deceased was about 65 years of age. The abdomen was distended with gas, rigor-mortis present only in the legs. The tongue was protruding from the right side of the mouth, there was frothy mucus about the nostrils. The lower jaw was partly dislocated and pushed to the right. The right upper eyelid was bruised, the right eye blood-shot. There was no mark of injury on the skin of the neck, but on removing the skin from the lower part of the face and the neck bruises were found on both sides, in the parotid regions and along the sides of the lower jaw. There was a bruise over the upper margin of the sternum extending for about two inches along the clavicles.

There were bruises beneath the scalp over the forehead and beneath both temporal muscles. The right side of the tongue was extensively bruised, the left side slightly.

On reflecting the parieties of the chest, bruises were found in the substance of the pectoral muscles, and fracture of the following ribs :—On the right side the second to the seventh, on the left the upper nine, the third, fourth and fifth right ribs were broken in two places.

There were a few petechial hæmorrhages in the mucous membrane of the larynx, none in the lungs which were congested.

The number of ribs broken was unusual, especially the fracture of the first rib on the left side and the double fracture of three of the right.

I found, however, that not only the ribs but also other long bones were abnormally frangible. I removed some of the unbroken ribs and found they were broken easily by being bent when held with one finger and the thumb of each hand at a short distance apart; a blow of moderate force fractured the tibia. There was, at the time, in the morgue, the body of a young woman. I removed the ribs corresponding to those of the old woman which had been tested, and found that I could not break them even when grasped with the whole force of the hands. The bones of the old woman shewed a very thin layer of compact tissue of a yellowish colour.

SUFFOCATION.

This term is applied to death occurring from—

1. Closure of the orifices of air passage.
2. The presence of foreign bodies in the air passage.
3. Compression of the chest walls, whereby the movements necessary for respiration are prevented.

Death generally takes place by asphyxia, but in some cases it occurs from cardio-respiratory inhibition or shock, the post-mortem appearances of which, as already mentioned, in a previous page, are indefinite. The medical jurist must be prepared to explain to the Court that, although, as a rule, death from the causes above mentioned takes place by asphyxia it may occur from shock or cardio-respiratory inhibition.

1. CLOSURE OF THE ORIFICES OF THE AIR PASSAGE —This is easily effected in the case of infants and of persons in an unconscious condition through drink, narcotics or other cause.

Infants have been accidentally suffocated in bed by slipping beneath heavy bed-clothes ; a drunken man was suffocated by a soft pillow slipping over his face, epileptics have died under similar circumstances.

Closure of the nose and mouth by the pressure of the hand or of a cloth is a common method of infanticide. If the closure is effected with the naked hand, bruises and finger marks will be found on the face, and about the nose and mouth. The tissues of an infant are so delicate that even slight violence will produce bruising.

In examining a case of suspected infanticide by closure of the mouth and nostrils, it is well to recollect that bruises, scratches and other signs of injury on the face may be the result of attempts to assist delivery ; as a rule a careful examination of the injuries will enable the medical jurist to distinguish them from the marks made in suffocating.

If the suffocation was effected by a cloth pressed over the mouth and nostrils, the pattern may be impressed on the skin ; a soft thick cloth pressed lightly over the face will suffocate without causing any local injury.

In infants suffocated in the ways above mentioned, the internal post-mortem appearances of asphyxia are, as a rule, well marked, the lungs congested, the right side of the heart and venous system filled with dark fluid blood, the air passage contains frothy, mucus fluid, often blood tinged, petechiæ on the lungs and heart are commonly present.

Homicidal suffocation of adults is rare, but in cases of strangulation and of throttling, not infrequently the head is enveloped in a cloth, the assailant having thrown a cloth over his victim to prevent crying out and then strangled or throttled. An instance of this is mentioned in the account of throttling.

Taylor mentions that a man was convicted for the murder of a woman by placing a pitch plaster over her face.

Adults in an unconscious state have been suffocated by a cloth put over the face, and a feeble person might be killed in this way, though probably not without struggling and sustaining injuries, which would show the nature of the case.

The post-mortem appearances will depend on the amount of violence used. An unconscious man could be killed by the application of a cloth over the face without any mark being caused ; the recognition of the nature of a case of this kind can only be made from the circumstances. Fortunately, as in homicide by other means, the murderer generally uses unnecessary violence and leaves traces by which the character of the act can be recognized. The internal appearances are those of asphyxia, petechiæ are not found except when there has been a long struggle.

2. THE PRESENCE OF FOREIGN BODIES IN THE AIR PASSAGE is a frequent cause of death, which may occur with extreme suddenness. It is not necessary that the foreign body should be of such size as to block the air passage, a small object may induce fatal spasm.

The post-mortem appearances are generally those of asphyxia but in some cases death occurs through cardio-respiratory inhibition or shock.

Accidental deaths from a foreign body in the air passage are not uncommon, several have been examined in the Calcutta morgue during the last eight years. In most of the cases, the history showed that the deceased was drunk, or in a few cases that he was subject to epilepsy. The following is a typical example :—The deceased, a syce, took his food in the evening and afterwards with two companions, drank a quantity of liquor ; all three slept in the same room on the floor ; in the morning his companions on waking up found the deceased dead. The post-mortem examination was held on the afternoon of the same day. The body was well nourished, there was vomit about the nostrils and mouth, the tongue was protruding, caught between the teeth and cyanosed. The conjunctivæ were suffused and studded with capillary hæmorrhages, the face was cyanosed, the vessels of the head and neck were distended, the blood was dark and fluid, the internal appearances were those of asphyxia ; there were no subpleural or subpericardial petechiæ.

The trachea and bronchi down to the smallest were filled with food similar to that in the stomach.

It may be pointed out that the presence of food in the trachea is a very common appearance in the post-mortem room in India, it does not imply that deceased died of suffocation, it is the result of the emptying of the stomach which occurs from the pressure of gases developed in the abdomen by putrefaction, the contents of the stomach forced through the œsophagus, readily enter the trachea. When suffocation is due to vomit, the latter is found drawn into the small bronchi.

The effects of the presence of small object in the air passage are seen in the following case :—The deceased, aged 18 months, went on to the verandah of her parent's house, where there was some dâl spread out to dry ; shortly after the mother heard her coughing violently, and found her speechless and choking. Suspecting that there was something in the child's throat, the mother put her finger down but felt nothing, she then took the child to hospital where it died before anything could be done. On post-mortem examination, the lungs were very congested and covered with areas of sub-pleural emphysema, the trachea and bronchi were congested and contained much frothy mucus, in the larynx there was a grain of dâl.

There are many recorded cases of sudden death while eating, due to food getting into the larynx ; in some of the cases, death occurred with exterme rapidity ; in others the persons were able to walk some distance, as in the case mentioned by Taylor, a man who was choked by swallowing a large piece of meat, immediately walked across the street to a chemist's shop and soon after entering, fell down in a state of insensisibility ; after death a piece of beef was found in the glottis.

Accidental choking is more likely to occur in persons under the influence of liquor, as the reflex excitability is diminished and the entrance of foreign matter into the larynx does not produce sufficient expulsive effort to ged rid of it.

In children accidents of this kind are not very uncommon ; sudden death of young infants may be caused by the accumulation of bronchial secretion, which the want of muscular development prevents them from expelling. In cases of this kind, the post-mortem examination reveals marked signs of asphyxia, numerous subpleural aud subpericardial petechiæ, and a quantity of mucus in the brouchi.

HOMICIDE BY THE INTRODUCTION OF FOREIGN BODIES.—This is a common method of infanticide, in some cases the child is killed as soon as the head is born, before respiration has taken place. The following is an example. The body of a new born male was found in a depôt for stones, it was mutilated, the left arm had been completely severed at the shoulder and was missing, the surface of the wound showed no sign of vital reaction. The body was a good deal decomposed, the remains of the navel cord softened, so that it was impossible to discover whether it had been cut or torn. The lungs exhibited no sign of respiration. In the pharynx, projecting into the larynx, there was a conical plug of cloth.

In other cases mud or cowdung is introduced, and not infrequently the pharynx is blocked by the finger. In the latter cases excoriations and bruises are caused about the fauces and in the pharynx.

Adults have been murdered by the introduction of a cloth or other foreign body into the pharynx, but as a rule the plugging of the mouth and pharynx is done with the object of preventing an alarm being raised, while death is caused in some other way. In THE REPORT ON THE MEDICO-LEGAL RETURNS, Harvey describes the case of a boy aged 12 years whose mouth, throat and bronchi, as far as the second and third divisions, were filled with black mud and sand.

Taylor mentions a case reported, by Littlejohn, of a woman in the upper part of whose larynx a quart-bottle cork was inserted tightly, fractures of ribs were found. At the trial, it was suggested that the deceased while extracting the cork from the bottle with her teeth, might, by the sudden impetus of the contained fluid, have drawn it into the position in which it was found. This theory was negatived by the sealed end of the cork being uppermost.

Suicide by closure of the air passage by a foreign substance is rare, the recorded cases have occurred among insanes ; a woman in an asylum killed herself by stuffing her mouth and pharynx tightly with a stocking.

3. SUFFOCATION BY PREVENTING THE MOVEMENTS OF THE CHEST. Accidental deaths from this cause are fairly common. I have seen several in the last seven years, most of them were the result of burial under fallen earth or houses. In the latter class, injuries of a more or less severe kind were generally present. The following is a typical case of death from being buried in an excavation, the deceased, a cooly, was digging in a deep trench when the sides caved in and he was buried. When the body was got out life was

extinct. On post-mortem examination no signs of injury were found ; the lungs were very congested and œdematous, there were scattered petechiæ over the posterior surface of both, the bronchi and trachea were filled with frothy mucus, the blood was dark and fluid, the right side of the heart and the venous system were distended.

Death by suffocation from pressure on the chest may occur in crowded assemblies, especially when a panic takes place.

HOMICIDE BY PRESSURE ON THE CHEST.

This is a not uncommon method of infanticide, the chest of the child is firmly grasped with the hands or pressure is made on the front of it, death occurs rapidly. Finger marks and bruises are found on the chest ; internally, the signs of asphyxia, petechial hæmorrhages are generally present on the lungs and heart.

Adults have been murdered by pressure on the chest, as a rule several persons are required, unless the individual was very feeble or in a helpless state from drink or narcotics. More often in homicidal cases, the murderer having thrown down his victim sits or kneels on his chest while killing in some other way. In cases of this kind bruises of the chest wall and fracture of ribs are generally present.

In England, a considerable number of deaths of infants occur through the custom, among the lower classes, of the young children sleeping with the parents. In some cases death is due to closure of the mouth and nostrils owing to the infant slipping beneath the bed clothes, in others it results from pressure on the chest caused by the parent, while asleep, rolling over on the child. Most of the cases are accidental, but some are probably homicidal. In the only case of overlaying, which I have met with, there were certain suspicious circumstances, but the Coroner's jury after inquiry returned a verdict of accidental death.

In India cases of overlaying are rare.

CHAPTER IX.

DROWNING.

When the entrance of air into the air passage is prevented or hindered by the presence of fluid, so that asphyxia results, death is said to be due to drowning. This term is also applied to cases where death is due to submersion in fluid, although not caused by asphyxia. If a man falls into water and death results, he is said to have been drowned. Death is generally due to asphyxia but not in all cases. In the older books on medical jurisprudence, deaths by drowning are classified as occurring by asphyxia, syncope, or a mixed condition. It is in the experience of every medical jurist to meet with cases of death by submersion, in which the post-mortem appearances of asphyxia are altogether absent ; such cases are generally returned as death from syncope. The recent researches of Brown-Séquard, Brouardel and others show that what probably happens in these cases is sudden permanent inhibition of the cardio-respiratory functions, due to the irritation of the sensory, cutaneous nasal and larynxeal nerves, by the fluid in which the body is submerged ; it seems probable that the mental shock experienced by the individual who finds himself in danger of drowning has, in many cases, an important influence in inhibiting the cardio-respiratory functions.

Cases of drowning, where death results from inhibition, are uncommon; as a general rule when a person dies from submersion, death is due to asphyxia caused by the interference with the entrance of air. What usually occurs, when a person finds his face submerged, is that he instinctively holds his breath, the act is in part voluntary, in part reflex from the irritation of the sensory nerves, especially those of the throat and nose. But he is unable to stop breathing for long, as the respiratory centres are soon stimulated beyond control by the venous blood, and violent respiratory movements take place, short jerky inspirations, followed at once by expirations. The face being submerged, the fluid is drawn into the air passage, from which, at first, it is expelled by the violent expiratory efforts its presence induces, but in a very short time, as the effects of deprival of air become more marked, the expulsion of the aspirated fluid is partial, and it accumulates in the air passages where it is churned up with the air into a frothy fluid ; at this period convulsions generally occur. After a short time the third stage of the process of asphyxia begins, the individual becomes unconscious, reflex irritability is rapidly lost, the respiratory movements are represented by short jerky inspirations, which, as the face is below water, result in the aspiration of quantities of fluid. The intervals between the inspirations become longer and longer, the mouth gapes, the limbs become contracted, finally all respiratory movements cease, the heart continues to beat feebly for a few moments then it too stops and the individual is dead.

It is evident that the post-mortem appearances of drowning must be dependent on the duration of the asphyxial process, particularly on the length of the third stage. Death may take place during the second stage or the third period may be very short. The post-mortem appearances, which are looked for and considered to be typical of drowning, can only be expected in cases where the asphyxial process has been slow and the third stage prolonged.

What usually happens when a person falls into water and is drowned is that, at first, he sinks to a depth proportionate to the momentum given to his body by the fall. Now finding himself under water he strikes out with his legs and arms, the movements of the limbs, even in the case of a non-swimmer, are sufficient to raise the body to the surface. Though the body is heavier than water, except in very fat people, especially very fat children in whom the skeleton is very small, the difference in specific gravity is only slight, viz., 1·08 against 1·005 and 1·003 for salt and fresh water, respectively, so that very little movement is sufficient to bring it to the surface. On finding his head out of water, he opens his mouth to breathe and call for assistance, and probably at the same time raises his arms out of the water ; the consequence is that the difference between the specific gravity of the now only partly submerged body and that of the displaced water being greatly increased and the movements of the legs not being sufficient to sustain the body, it sinks and in sinking, water gets into the open mouth, the fluid is partly expelled, partly swallowed thereby adding to the weight of the body. When he again finds himself under water, he moves his arms and legs and is again brought to the surface, where as before he opens his mouth to breathe and call for assistance and waves his arms above the water and again sinks. The process may be repeated many times, depending on the strength and endurance of the individual. The common belief that a person in drowning rises three times is like most popular beliefs inaccurate, he may rise three times or oftener or on the other hand he may rise only once or twice. The result in any case is that being exhausted by muscular exertion and by the efforts to obtain air he sinks, water is drawn into his lungs, convulsions occur. The third stage of asphyxia takes place and the man dies. The body remains beneath the water unless removed, until the development of gas by putrefaction diminishes its specific gravity ; when this has happened it rises to the surface unless prevented by being entangled in weeds, or by other means.

A swimmer is able to keep himself afloat for a time which depends on his skill and endurance, but in the end he is exhausted and drowns in the same way as the non-swimmer.

POST-MORTEM APPEARANCES.

From the foregoing account of the mechanism of drowning, it will be evident that the post-mortem appearances vary according to duration of the asphyxial process. But besides this the signs found in the body of a drowned person depend much on the duration of the submersion and on the interval that has elapsed between the recovery of the body from the water and the post-mortem examination.

It is, as a rule, not difficult to determine the cause of death in a fresh body which has been only a short time in the water and which is examined soon after removal, but the case is very different, when, as is usual in India, the body is in a state of advanced decomposition from long immersion and delay in bringing it to the medical jurist. In Calcutta, the Police Surgeon examines every year several cases of drowning ; fewer of late owing to the smaller number of ships, carrying European crews, lying in the port ; in less than one-third of the cases the examination is made on a fresh corpse, and of the remainder, many of the bodies are extremely decomposed. To add to the difficulty in arriving at a positive conclusion, the history seldom goes beyond the statement that the body was found floating.

In a fresh body, which has been only a short time in the water and which is examined soon after removal, the following appearances may be expected :—The clothing is wet, often muddy, weeds may be entangled in it. The surface of the body is wet and cold. There may be mud on the hair, about the nose and mouth and in the ears. The hands are often muddy, about the nails and between the fingers, from the deceased having grasped the bottom or the banks, weeds may be found between the fingers and in the palms of the hands. The condition of the feet if naked will be similiar.

If the body has remained in the water upwards of an hour, the cuticle of the hands and feet and of other situations where it is thick, knees, elbows, presents a soddened appearance due to imbibition. The appearance known as " goose skin " or cutis anserina may be present ; the skin is in a corrugated condition from contraction of the arrectores pilorum. It is not confined to drowning, it may be found in death from any form of violence. Moreover, it is not necessarily a vital phenomenon, it can be produced after death while the muscles retain their irritability. It is, nevertheless, a sign of value and should always be looked for. Contraction of the penis and scrotum is due to the same cause as cutis anserina and has the same diagnostic value.

The next sign to which attention will be directed is the presence of fine lathery froth about the nose and mouth ; it is a a very valuable indication of the mode of death. If not visible when the body is seen, pressure on the chest may cause its appearance, by driving froth out of the air passages. This sign is considered to be the most valuable of the external indications of drowning, but while admitting its importance, I must point out that it is not peculiar to drowning, but may be found in cases of slow asphyxia from other causes. I have many times seen a typical bunch of fine lathery froth about the nostrils in cases of opium poisoning. The lathery froth is produced by the churning up of air and fluid in the air passsages, and as in cases of slow asphyxia much fluid exudes from the congested vessels, fine lathery froth, the fineness depends on the presence of exudation, may be found in as typical form in asphyxia from other causes as in drowning, but at the same time it is unquestionably much more common and abundant in drowning. In place of froth, watery fluid may exude from the mouth and nostrils on moving the body.

THE INTERNAL APPEARANCES. The pharynx, larynx, trachea and bronchi are filled with frothy fluid. The lungs, on opening the thorax, are found to be large, bulge forwards, a condition called "ballooning;" they do not collapse; their consistence is doughy, soddened, and they retain the impression of the fingers when pressed, they are less crepitant than normal. On section, they are found to be congested and to contain much watery fluid. During the third stage of drowning, the fluid in which the body is submerged is drawn into the lungs and according to Paltauf, penetrates to the air cells and from them passes through the softened cement substance into the lung tissue. Lesser holds that the aspirated fluid does not get to the air vesicles, and he considers the watery fluid found in the lung tissue to be a transudation from the over distended capillaries.

This theory receives support from what is seen in cases of asphyxia from other causes, for example poisoning by opium, in which death has occurred slowly; in such cases, the lungs are very congested and on section blood and watery fluid pour out in large quantities. It may well be that in drowning the lung tissue contains both exudation from the vessels and fluid aspirated during the death struggle. Falk and Brouardel have shown that fluid aspirated into the lungs may make its way into the blood vessels and may be detected in the left side of the heart.

The blood is dark in colour and fluid, and may be more watery than normal. The pulmonary artery, the right side of the heart and the venous system are distended.

In many cases the stomach contains water; in the early stage of the drowning process when water gets into the mouth, a portion is swallowed. The amount of water in the stomach varies, and unless the quantity is considerable or the fluid presents some peculiarity by which its source can be traced, it is not a sign of much diagnostic value.

Water may be found in the small intestine; this is a sign of great value in deciding the question of submersion during life.

It must be accepted as possible that water may enter the stomach after death, but it cannot pass into the intestine owing to the resistance of the pylorus, which could only be overcome by strong pressure. Hence a quantity of water in the intestine is strong evidence of death by drowning.

Regarding the entrance of water into the stomach after death, numerous experiments have been made, and in a few instances, water has made its way into the stomach, generally in a small quantity. In India where putrefaction occurs so rapidly, the post-mortem entry of water into the stomach which, in the experiments, took place only after long submersion, is hardly possible.

In a large percentage of cases of drowning, mud, sand or other substances derived from the medium in which death took place, are found in the air passage, stomach or intestine or in all three, though much less often in the intestine than in the other two situations. The air passage has been frequently found, in the cases examined at the Calcutta Morgue, filled with mud down to the smallest traceable bronchi ; recently in a European who fell head foremost into the Kidderpore dock and whose body floated after twenty-four hours, the air passage was filled with mud, and three halves of shells nearly an inch long, were stuck in the larger bronchi. The stomach and the intestine may also contain much mud but, as a rule, the quantity is small both in them and in the air passage. When mud is found in either of these situations, the opinion that death was due to drowning may be confidently given, provided the circumstances are not such as to negative this cause. It is necessary to point out that the mud to have a diagnostic value must, in the case of the air passage, be found below the rima glottis.

Unfortunately in the larger number of cases of suspected drowning mud is not found, nor water in the stomach or intestine in sufficient quantity to be of diagnostic value, and the task of the medical jurist is more difficult. The determination of the cause of death in these cases will rest on a complete post-mortem examination, the exclusion of other causes of asphyxia, and a careful weighing of the history of the case.

The body of a drowned person remains submerged until the development of gases by putrefaction diminishes its specific gravity below that of the medium. When this takes place it rises to the surface unless prevented by weeds or other causes. In Calcutta where the factors favourable to putrefaction are always present, the body floats usually in about twenty-four hours in the River Hooghly, in somewhat less time in the tanks. Mackenzie gives in or within twenty-four hours after immersion in the Hooghly during the hot and rainy seasons, and from two to three days in the cold weather. My observations corroborate his as regards the hot weather and rains, but for the cold season I consider from one to two days is the usual time for a body to float ; much depends on the condition of the corpse and on its proneness to putrefy.

As mentioned previously, the medical jurist in India generally finds the bodies, in cases of suspected drowning, in a more or less decomposed state when brought for examination, and consequently the task of determining the cause of death, besides being extremely disagreeable, is one of great difficulty, more especially as very often the only history obtainable is the fact that the body was found floating in water.

I extract from my notes, the following account of a case which may be taken as typical of a large proportion of the cases of drowning which the Police Surgeon of Calcutta is required to examine, further it shows that the identity of even a European may not be discovered. The report sent by the Police states that the body was found floating in a tank on the Maidan, on the morning of the 5th November 1896. The post-mortem was held early in the afternoon of the same day. The body was very decomposed ; the clothes were stretched and in places had burst, owing to the enormous swelling; they consisted of a khakee coat and trousers, a shirt and inner vest, and drawers. Inside the drawers there were several pieces of brick and stones ; attached to the belt of a truss which the deceased was wearing, there was a pillow case containing a quantity of broken bricks and stones. The features were unrecognisable, enormously swollen, the eyes putrid and protruding, gas was bubbling from the orbits, nose and mouth. The lips were everted, swollen, the tongue protruding. The cuticle was loosened, most of it was detached in removing the clothes ; that of the fingers and toes came off in a glove-like mass.

The internal organs were putrid, the lungs, soft and pultaceous, floated on the fluid in the pleural sacs ; the right pleura contained eight ounces, and the left ten ounces of reddish putrid fluid. The lining of the right ventricle was stained red, that of the left ventricle was pale, unstained. The trachea and bronchi were empty

The viscera were sent to the Chemical Examiner ; no poison was found. There were no marks of violence.

At the Coroner's court I gave the opinion that the deceased died of drowning. This conclusion was based on the post-mortem appearances, the result of the analysis of the viscera, the absence of marks of violence and of other causes of death, the circumstances of the case. The body was found in a tank on the Maidan, fully clothed (there were shoes and socks on the feet) with pieces of brick and stones inside the drawers and with a pillow case containing bricks and stones fastened to the belt of a truss. These circumstances pointed strongly to suicidal drowning.

Attention will now be directed to a consideration of the appearances when death is caused by drowning and the body has remained long in the water and is in a condition of advanced putrefaction when examined.

The froth about the nostrils and in the air-passage disappears soon, and no trace of it will be found in a putrid body ; fluid also disappears from the air passage, the stomach and intestine, though not for some time after the disappearance of froth. The fluid transudes through the tissues as they become softened by putrefaction. The fluid from the lungs accumulates in the pleural sacs. When an individual dies of asphyxia caused by submersion, the lungs, as a rule, contain much fluid, blood, serous exudation, and aspirated water ; consequently when the lung tissue is softened by putrefaction and the fluid transudes from it, a large accumulation takes place in the pleura ; the quantity may be very great, and on opening the thorax the lungs may bulge forward, being floated on the fluid.

In death by asphyxia the right side of the heart is distended with blood, the left side empty. When putrefaction occurs, the colouring matter is set free from the red cells and stains the endocardium.

The two appearances mentioned, namely, accumulation of fluid in the pleural sacs, and staining of the lining of the right ventricle are of value in determining the extremely difficult question of the cause of death in a putrid body ; of course they only indicate that death took place by asphyxia, but if the quantity of fluid in the pleuræ is large and narcotic poisoning can be excluded, the probability that the case is one of drowning is strong. In asphyxia from hanging, strangulation, throttling or other violent means, marks of injury may be expected, and these will still be visible until the skin has undergone complete dissolution, by which time all internal evidence of the mode of death will have disappeared.

Although fluids disappear from the air passages, stomach and intestines when putrefaction is advanced, solid matter, mud, sand or other foreign substance remains, and as the statistics which follow show, in many cases of drowning notwithstanding the putrid condition of the body, a positive opinion as to the cause of death can be given, on finding in the air passage below the larynx or in the stomach or intestine, mud, sand or other matter. The presence of these substances on the tongue or in the nose and pharynx is of no diagnostic value.

Between June 1893 and November 1900, excluding three months absence on leave, I examined 157 cases of asphyxia due to drowning. I exclude deaths in water, from cardio-respiratory inhibition, or from injury. Of the 157 cases, in 55 the bodies were fresh at the time of examination ; 21 were slightly decomposed, that is signs of putrefaction were present, swelling of the body, cloudiness and softening of the conjunctivæ, putrefaction of the blood beginning, the surface of the body discoloured ; in the remaining 81 putrefaction was far advanced, the bodies enormously swollen, the cuticle peeling off or gone, the eyes protruding and putrid, gases bubbling from the nostrils and orbits, the brain liquefied, all organs putrid, the blood completely decomposed. In some of the bodies the stomach was pultaceous, the lungs also completely decomposed.

The occurrence of fluid and mud in the air passage, stomach and intestine is shown in the following tabular statements. Fluid includes frothy and non-frothy fluid ; mud includes all solid matter, gravel, weeds, shells, etc. Air passage implies the larynx, trachea and bronchi ; of course in nearly all bodies that have been submerged, fluid or mud will be found in the mouth, nose and pharynx, but in these situations its presence is of no diagnostic value.

As regards fluid in the stomach, cases in which only a small quantity of water was present are not reckoned, unless the water presented some distinctive peculiarity, or unless water was also present in the air passage or the intestine. The presence of fluid in the intestine was judged in the same way.

FRESH BODIES—55.	Fluid.	Mud.	
Air Passage	20	2	
„ „ and stomach ...	16	6	
„ „ „ „ and intestine	7	1	
„ „ and intestine ...	1	0	
Stomach	0	0	
Intestine	1	0	
Stomach and intestine ...	1	0	
	46	9	55

In these 55 fresh bodies the appearances of asphyxia were well marked, and in all, special signs indicative of drowning were found, hence the diagnosis was easy. It will be seen that fluid was found in the intestine alone in 1, the quantity was very large; in the stomach and intestine in 1; in the air passage and stomach in 16; in the air passage, stomach and intestine in 7; in the air passage and intestine in 1; in the air passage alone in 20, in this situation the fluid was generally frothy, and fine lathery froth was frequently found about the nostrils.

The mud found in the air passage was mixed with frothy fluid, and in the stomach and intestines with fluid.

SLIGHTLY DECOMPOSED BODIES—21.	Fluid.	Mud.
Air Passage ...	0	4
„ „ and stomach ...	5	2
„ „ „ „ and intestine...	1	0
„ „ and intestine ...	1	0
Stomach	0	0
Intestine	0	0
Stomach and intestine	0	2
	7	8=15
Neither fluid nor mud ...		6=21

Froth was not found in any of these 21 slightly decomposed bodies, in 5 the air passage and stomach contained fluid, in 1 fluid was present in the air passage, stomach and intestine, and in 1 in the air passage and intestine. The fluid in the air passage was generally of a reddish colour from transuded blood. The mud was mixed with fluid. It will be observed, that in 6, that is in almost one-third of the cases, neither fluid nor mud was found, the diagnosis of these cases was made from the history of the case, the signs of death by asphyxia and the absence of all other causes for this condition.

Putrid Bodies—81.	Fluid.	Mud.
Air passage	0	19
„ „ and stomach ...	0	8
„ „ „ „ and intestine	0	5
„ „ and intestine ...	0	2
Stomach	1	8
Intestine	1	1
Stomach and intestine ...	1	1
	3	44=47
Neither mud nor fluid ...		34=81

Of the 81 putrid bodies, in 47 signs were found upon which a diagnosis could be made, in 44 mud was present, in 3 fluid in large quantity. As a rule in putrid bodies there is no fluid in the air passage, stomach and intestines, and if mud is present it is found adhering to the walls. In 34 of these cases, the opinion that death was due to drowning was based upon the history, the signs of asphyxia and absence of all other causes. In several cases where the circumstances were such, as to give rise to the suspicion of the possibility of poisoning, the viscera were sent for chemical analysis ; in none was poison discovered. Many of the bodies were much mutilated by fish or turtles.

Having decided that death was due to drowning the further and more important question to be determined is, was it due to accident, suicide or homicide?

There is no sign of drowning which enables us to answer this question, the phenomena are the same in accident, suicide and homicide. The character of a case can only be decided by the circumstances. Accidental and suicidal drowning is common in all countries ; murder by drowning is rare, and the victims are mostly children, less frequently women, and adult men very rarely. Chevers mentions some cases of the murder of adult men by drowning ; one of a man walking along the bank of a river when he was seized, dragged into the water and held under until dead. Another, a thief was seen to trip up and seize a traveller as they were walking through shallow water, and hold him under until life was extinct. Chevers also mentions that the author of the Seir Mutaqhuerin alludes to the practice of conveying young men, in meat doolies, into seraglios, where they were ultimately thrown into wells by the ladies, or on detection by their masters.

In September 1900, a nacoda or native ship-captain and a chuprassi got into a dinghy to go to a steamer lying in the Hooghly. On arriving alongside, the chuprassi offered one pice as his fare. The boatman demanded two. A quarrel ensued, and the nacoda who had paid two pice, and was actually standing on the ship's companion ladder, returned to the dinghy to try to settle the dispute. In the course of the discussion the boatman pushed both the men, they fell into the river. The nacoda sank at once and was not again seen alive, the chuprassi came to the surface and was rescued. The nacoda's body was recovered on the third day, in a very decomposed state. There were no signs of injury and death was due to drowning. The boatman was convicted at the High Court on the minor charge and sentenced to 4 years' rigorous imprisonment.

In a dangerous river, such as the Hooghly is at all times, but especially during the rainy season, a man, though he be a good swimmer, has little chance of saving himself if he falls or is pushed in, and having regard to the notoriously lawless character of the boatmen of the Bengal rivers, it seems probable that deaths from drowning, which are now considered to be the result of accident or of suicide, are often of the same kind as the case of the nacoda.

Homicidal drowning of children appears to be commoner in other parts of India than in Lower Bengal. Chevers mentions several cases ; in some the motive was revenge, in others the children were robbed and then thrown into wells. In several cases quoted by Chevers, women, who had been ill treated, drowned their children. A Hindu woman, at Jaunpore, drowned her female infant, a year and a half old, in an indara, apparently to revenge herself upon her husband, who had slapped her face. Another woman, who had been abused and beaten by her husband, threw her son, a child of two, into a well where he was drowned.

In the report on medico-legal returns for 1870, 71, 72 Harvey states that 21 cases of drowning were certainly, and 32 more possibly homicidal. Of the undoubtedly homicidal cases 15 were in children, 4 in adults; in the others, the age is not mentioned. In Dixon Mann's Forensic Medicine the statistics of drowning in England and Wales in the decennium 1886 to 1895 are quoted from the Registrar-General's reports:—The total number of deaths from drowning was 31,904. Of these 26,354 were due to accident, 5,367 to suicide and 153 to homicide, of the homicidal cases 75 were males, of whom 69 were under 5 years of age, and 78 females, of whom 70 were under 5 years of age.

Brigade-Surgeon Mackenzie, in 305 cases of drowning, found 231 were accidental, 8 were suicidal, 1 was homicidal, and as regards 65 the Police were unable to assign any cause.

In 157 cases of asphyxia due to drowning examined by me, 106 (73 males, 10 females, 23 children) were reported as accidental, 16 (12 males, 4 females,) as suicidal, and as regards 35 (27 males, 6 females, 2 children) no opinion was given by the Police.

The case of homicide reported by Dr. Mackenzie was of a girl who, after being robbed, was pushed into a tank and held by the neck below water until life was extinct. The murder was committed by a woman.

In 1899, a similar case occurred in Calcutta, a boy aged about 8 years, was robbed, pushed into a tank and held under water until dead. Death was brought about by syncope or inhibition, and the case is not included in the foregoing statistics of drowning.

The experience of England and India shows that murder by drowning, except in the case of children, is so rare that when death is found to be due to drowning, the presumption is strongly in favour of accident or suicide.

Of course this does not remove the necessity for careful investigation of the post-mortem appearances and the circumstances of every case. The medical jurist should make a careful and complete post-mortem examination and note in detail every mark of injury present on the body, especially as regards their ante-mortem or post-mortem origin. Bodies found in water not infrequently exhibit marks of injury, it is not possible to go into the details of the injuries, which may be found. Among the cases examined at the Calcutta Morgue, during the last seven years, in several, bruises, abrasions, scalp-wounds, and wounds of other parts, have been found. In one case two long but not deep wounds were found on the throat. It appears that deceased, a European, had tried to murder a woman who had refused to marry him, by shooting at her with a revolver, he then attempted to shoot himself, failing, tried to cut his throat with a razor, and finally succeeded in putting an end to himself by jumping into a tank. Wounds of the throat in the bodies of persons drowned usually indicate suicide.

Injuries exhibiting signs of vital origin, may be found on the bodies of drowned persons; they may be due to the body having struck the bottom, or some hard object in the water, or, they may be caused by violence inflicted by others. A careful examination of the injuries may enable the medical jurist to decide this question, but in many instances it is impossible for him to do more than to describe to the Court the different ways the injuries could have been produced. In a case of drowning examined by me, I found, on the back of the head, a small bruise, the police report stated that it was alleged that the deceased had been pushed off a boat, and when he tried to climb in again, he had been struck on the head with a lathi or club. In reply to the Coroner's questions, I stated that the injury could have been caused by a blow, that a slight blow would produce it. and that it could have been caused by the deceased striking his head against the bottom of the boat or to his having struck against some object, such as a floating piece of wood, when falling into the water. It is obvious that in many cases, in fact in most, the injuries found will not present any peculiar features by which their causation can be determined by the medical jurist. Fractures of the skull, dislocations of the neck, fractures and dislocations of limbs, have resulted from falls into water. The question as to whether a particular injury was due to violence inflicted by another person, or was produced by a fall, or in other manner, is for the jury to decide. The medical jurist is able to assist by describing the injury and the different ways it could have been caused, but the decision rests with the jury.

After death, while in the water, the body may be injured by fish, turtles, etc. Many of the bodies recovered from the Hooghly are horribly mutilated. In the case of a European, who was drowned by the capsizing of a dinghy during a squall, and whose body was recovered on the fourth day, nearly the whole of the internal organs had been eaten, the bones of the arms were quite bare, the flesh gone off the face. In a fast running river, such as the Hooghly, injuries may be inflicted after death by the body being dashed against boats, mooring chains, etc., and organs, especially the spleen if enlarged, may be ruptured.

Drowning may take place in shallow water, such cases are usually accidental or suicidal. In some of my cases where death occurred in very shallow water, the deceased was subject to epilepsy. The following case illustrates the extraordinary apathy of people of the lower class in India. The Police report states, "deceased had been subject to epilepsy for years. On the 11th February 1894, he was washing his mouth by the river side, standing in the water, when he got a fit and fell down, the lower part of his body only, remaining in the river. Three bystanders went to his assistance, but seeing no motion in the body, left him there for dead; it being flood tide at the time, the whole body was soon covered by the water." The post-mortem showed that death was due to drowning.

The limbs may be found tied together and weights may be attached to the body, the indication is generally of suicide, but of course, the way the limbs are tied is of the greatest importance and should be carefully noted. The knots must be examined and the question considered, could deceased have tied himself in the manner found?

A case, which occurred in 1897, would have been considered one of homicide, had no history been available. A student of a Mahomedan College, in Calcutta, became insane and was removed to the house of some of his relatives, while arrangements were being made to send him to his home. He was violent, and for security the relatives tied his hands behind his back, and bound his arms to his sides with a cloth. They put him into a room, in which there was a window overlooking a tank. During the night a splash was heard in the tank, and on going to the room occupied by the student, it was found empty. Search was made, and the body was discovered in the tank.

In another case, the body of an old man was found floating in a tank close to his house, the left arm was bound to the side by several turns of rope and cloth ; the right arm was across the chest, the right hand inserted beneath one of the turns of cloth ; attached to the body, there were two earthen gurrahs, two stones, a brick, two brass cups and two brass thallies or plates.

The history showed that deceased had been in bad health for some time ; death was due to drowning. The circumstances pointed strongly to suicide, but the jury took another view and returned a verdict of murder against the son of the deceased who had left Calcutta the day his father was last seen alive. At the High Court the case was not proceeded with.

In cases of drowning, the medical expert can generally state the cause of death, but as to the further and most important matter, he is seldom able to do much ; if injuries are found, he can determine, as a rule, whether they were of vital or post-mortem origin ; he can also give an opinion as to their importance, and he may be able to materially assist in the investigation of their causation by being in a position to state that they could or could not have been produced in the manner described by other witnesses. In India a medical man is often able to prevent a miscarriage of justice by pointing out the impossibility or improbability of the account given by persons, who come forward as having been eyewitnesses to an occurrence.

CHAPTER X.

MECHANICAL INJURIES AND WOUNDS.

For medico-legal purposes, it is unnecessary to determine whether a certain injury is or is not a wound; injuries of every kind come within the sections of the Indian Penal Code dealing with offences affecting the human body. According to Section 319. “Whoever causes bodily pain, disease or infirmity to any person is said to cause hurt.”—Section 320. The following kinds of hurt only are designated as “grievous”:—

First.—Emasculation.
Secondly.—Permanent privation of the sight of either eye.
Thirdly.—Permanent privation of the hearing of either ear.
Fourthly.—Privation of any member or joint.
Fifthly.—Destruction or permanent impairing of the powers of any member, or joint.
Sixthly.—Permanent disfiguration of the head or face.
Seventhly.—Fracture or dislocation of a bone or tooth.
Eighthly.—Any hurt which endangers life or which causes the sufferer to be, during the space of twenty days, in severe bodily pain, or unable to follow his ordinary pursuits.”

Section 321 deals with voluntarily causing hurt; section 322 with voluntarily causing grievous hurt; section 324 with voluntarily causing hurt by dangerous weapons, and section 326 with voluntarily causing grievous hurt by dangerous weapons or means.

It is unnecessary to quote further from the Indian Penal Code. It is evident that injuries of every description come under one or other of its sections.

When an individual who has sustained an injury is sent to Hospital, the Police request the medical officer to fill in a form, Police Code No. 189, on the front of the form the Police enter “all that is at present known of the case”; the back is divided into six columns with the following headings:—

1	2	3
Nature of injury, *i.e.*, a cut, a bruise, or a burn, etc., etc.	Size of injury, in inches, *i.e.*, length, breadth and depth.	On what part of the body inflicted.
4	5	6
Slight, severe or dangerous.	By what kind of weapon inflicted.	Remarks.

It will be observed that the classification of the injuries in column 4 is “slight, severe or dangerous,” and that the terms hurt and grievous hurt are not used ; no doubt, this has been done advisedly in order that the medical officer should not be required to attempt to classify injuries in accordance with the Penal Code. It is for the legal authorities to say under what section of the Code an injury comes ; the opinion of the medical officer may be asked, but the decision rests with the Magistrate.

Column 5 can generally be filled, only by stating that the injuries could have been caused in the way described by the patient, or in the account furnished by the Police ; in most cases, injuries do not exhibit such signs or peculiarities, as to show their causation by one weapon, in one way, and only by it ; as a rule, a cut, a bruise, or other injury, could have been caused by different weapons or in different ways. The medical officer should be on his guard against making a positive statement that an injury was caused by a certain weapon, he should only state that it could have been so produced, without excluding the possibility of other means.

It is well to bear in mind that injured persons, not infrequently, make statements regarding the way they were injured, which subsequently prove false, intentionally or unintentionally ; a man engaged in a quarrel is generally too excited to observe accurately what occurs. Intentional false statements are very common, generally with the view of enhancing the offence and consequently increasing the punishment to which the aggressor is liable. A man, brought to Hospital, stated positively that the scalp-wound, which he had received, was caused by a blow from a stick ; there was nothing peculiar in the appearance of the wound which could have been caused in the manner described or by a fall. At the subsequent investigation of the case, the man's statement was proved to be false. In some cases, the injuries present appearances which clearly indicate that the statement made by the injured man is false ; the medical officer should record his opinion that the injuries could not have been produced in the manner alleged.

On the front of the form there is a foot note requesting immediate notice if there is any fear of the case terminating fatally, or should unfavourable symptoms set in at a later period, in order that no time may be lost in having the dying declaration of the patient recorded on oath by a Magistrate.

CONTUSIONS.

A CONTUSION or bruise is an injury to the tissues without breach of surface, generally caused by a blow with a blunt object, or by a fall or by pressure. The injury consists of crushing or tearing of the tissues and rupture of blood vessels, generally of capillaries and small vessels, with consequent extravasations of blood,

Contusions are common injuries and are met with in every degree of severity, from the small bruise, which disappears rapidly, to the extensive injury accompanied by complete pulping of the tissues and rupture of large blood vessels, which may be immediately fatal from shock or subsequently from inflammation and gangrene of the part.

In superficial contusions, the extravasated blood produces discoloration of the skin, or ecchymosis, within a few minutes; the colour varies, it is generally purplish black, deeper in the centre than at the margins; subsequently during absorption, the hæmoglobin of the effused blood undergoes alterations, in consequence of which the colour of the bruise passes through a series of changes, black, brown, green and yellow, the last fading gradually into the normal hue of the part.

When a bruise is deeply seated, an interval of some hours but which may extend to days or even weeks, occurs before the extravasated blood reaches the surface, and, as in its course, it follows the line of least resistance, the ecchymosis may appear at a distance from the seat of injury. If the extravasation is long in reaching the surface, the blood will have undergone changes and the ecchymosis will be brown, green, or yellow. The anatomical arrangement may prevent the extravasated blood from coming to the surface, its presence can only be detected by fluctuation on palpation.

In fatal cases death may occur before discoloration of the surface has taken place, and bruises of large size may escape detection even if a post-mortem examination is held, unless every part of the body is deeply incised. On the other hand, a bruise, invisible during life, may become apparent after death by the gravitation of the effused blood to the surface.

In the production of a contusion, the amount of violence is not the only factor requiring consideration. The situation and structure of the part subjected to the violence, and the general condition of the individual are factors of great importance. In certain parts of the body, a bruise is more easily produced than in others; tissues lying on bone, the scalp, the cheeks, are bruised by a blow which would have no effect in more fleshy parts. In certain situations, great violence may be applied without causing contusion of the surface; blows and kicks on the abdomen, and even the passage of the wheel of a heavy vehicle, seldom produce any external sign of bruising, owing to the wall of the abdomen being free to recede from the blow, the force of which is expended on the internal organs.

The condition of the individual influences the result produced by a blow or other form of violence; women and children are more easily bruised than men, in some women slight pressure results in a bruise and in these cases the absorption of the extravasated blood is unusually slow. The tissues of a person accustomed to hard manual labour, and of a trained athlete, withstand severe blows without showing any sign of bruising.

In purpura, scurvy and other diseased conditions bruises are produced by slight violence.

The quantity of blood effused in a contusion depends on the size and number of blood vessels ruptured, and largely, on the structure of the part; in dense compact tissues bleeding from the torn vessels is quickly stopped by pressure, whereas in loose structures a large widespread extravasation is produced by moderate violence.

A contusion seldom presents such peculiarities of form as clearly indicate the means by which it was caused, and a medical expert, when called on to answer the question "by what kind of weapon inflicted," should exercise great caution. In assault cases the injured person is inclined to exaggerate his injuries, and not infrequently gives an untruthful account of their causation. In most cases the medical expert can only state that the injuries could have been caused in the manner described or by the weapon shown; he may sometimes be able to disprove a false statement.

Contusions are seldom dangerous, except when accompanied by much crushing of the tissues and a large extravasation of blood, but a number of small bruises, individually insignificant, in the aggregate, may prove dangerous owing to the nervous irritation and subsequent wound fever they may cause. Blows with yielding objects such as a sand-bag, cause no external mark, as the weapon adapts itself to the part struck and the force of the blow is transmitted to deeper structures ; a blow of a weapon of the kind mentioned, on the head or over the spine, may cause death by extravasation of blood on the brain or cord without the slightest sign of injury externally.

In assault cases, the medical expert is likely to be asked whether the injuries found could have been caused by a fall as alleged by the defence. In some cases, from the position and arrangement of the injuries, he may be able to answer the question, but very often he can only say they could have been caused either by a fall or by blows. In replying to the question, what amount of violence caused the injuries, consideration must be given to the effect of situation, the protective action of clothing, and the condition of the individual. Another question which may be put is,—when were the bruises caused ? Recent superficial contusions are circumscribed swellings, very tender and of a purplish red colour ; in about 24 hours the swelling is considerably lessened and the colour is changing to brown or green, at the margins. In a healthy person absorption is rapid and all signs may have disappeared in two or three days. If the bruise is large, the time required for absorption may extend to days or weeks ; the condition of the individual is of great importance in this connection ; a black eye which in most persons has completely disappeared in a week or ten days, may, in some, require one or two months for entire removal. In a case of bruise of the forehead, the result of a blow of moderate force, a large quantity of blood was effused, which gravitated into the eyelids, and did not completely disappear for seven weeks, and for some time longer, the skin of the eyelid retained a yellow tint. When bruises are found in a dead body, the question of their ante-mortem or post-mortem origin has to be decided. If swelling is present and changes have taken place in the effused blood, the vital origin of the injury is placed beyond doubt. Difficulty can only arise when death has followed very soon and, even in these cases, only with regard to small bruises. The experiments of Sir Robert Christison go to show that it is possible within two hours after death to produce a bruise which cannot with certainty be distinguished from one caused during life. He found that to produce a bruise on the dead body much greater force was required than would be necessary in a living person, and that great violence resulted only in a small bruise. I made some experiments to test Christison's conclusions in this country. I found that in a body of a man, half an hour after death, a blow of great violence resulted in a small effusion of blood in the subcutaneous tissues; a bamboo about 1½ inches in diameter and 4 feet long was used, and the blows were given by a strong dome with all his force. The result of a single blow was very slight, no sign externally, on reflecting the skin, a small quantity of blood was found in the subcutaneous tissues, it was not infiltrated but lay on the surface and could be removed completely without difficulty. Several blows on the same site produced flattening of the surface, and on dissection a larger quantity of blood was found and some fibres of the muscle were torn and pulpy, but not infiltrated with blood, they were quite pale. The results could not have been mistaken for an ante-mortem injury.

A bruise of large size containing coagulated blood with infiltration of the skin and tissues can only be of vital origin, a large extravasation cannot occur after the heart has ceased to beat; as regards small contusions, if the effused blood has penetrated the skin and tissues, the injury must have been produced during life. The only case in which difficulty is likely to be experienced is in small extravasations deeply seated, careful examination will show the infiltration of the blood into the muscle fibre, if the injury is of vital origin; if caused after death the blood will lie on the tissues and can be completely wiped off.

In dead bodies brown, hard, dry, parchment-like patches are very frequently found on the skin, mostly over bony projections and parts exposed to injury. They are produced by abrasion of the cuticle and subsequent drying of the exposed cutis, and may be caused during life or after death. There is no sign by which those of vital origin can be distinguished, unless the abrasion has involved the cutis and ruptured capillaries, the blood from which would colour the patch. In most cases the patches are of post-mortem origin due to careless handling of the corpse; they may be mistaken for bruises. In several reports sent to me, bruises were mentioned, which, on examination, were found to be skin patches. There is no difficulty in making a diagnosis. On incision, extravasated blood is found in a bruise, there is none in a patch. Of course abrasions and bruises may exist together, and not infrequently, the skin over a bruise is found to be abraded ; in these cases dried blood is, as a rule, found on the surface.

Wounds.

Wounds are divided into incised, punctured and lacerated. This classification is known in law Courts, and for that reason may be followed. It is not used in the Indian Penal Code.

Incised wounds are those produced by an instrument possessing an edge of a sharpness sufficient to divide the tissues when used with a cutting or sweeping motion. The instruments commonly employed are knives, razors, swords, daos, hatchets, and weapons of a similar description, but a piece of glass or crockery with a sharp edge, or a piece of tin, or sheet iron, is capable of making an incised wound.

In the living body, an incised wound is characterised by gaping, due to retraction of the divided tissues, free bleeding, the blood being fresh coagulates in and about the wound, and if small arteries have been divided marks of spirting will be found. The edges of the wound are injected, and if the individual survived for a short time, swelling and tumefaction will be present. If an incised wound has been made with an instrument possessing an even sharp edge, the margins will be smooth and clean cut. The extent of the gaping depends on the position, size, and direction of the wound, and on the nature of the divided tissues, skin is highly elastic and retracts freely unless it is closely bound to the underlying structures, as in the scalp. If muscle fibres are divided transversely great gaping results.

A wound produced by a weapon with an irregular or notched edge may exhibit a corresponding irregularity or jaggedness, but not always. Moreover of several wounds caused by the same weapon, some may be jagged, others smooth and even, the explanation is that in the one, the skin was divided by a notched part of the blade, and in the other, by a smooth portion.

A wound made with a blunt, or even with a sharp knife, may be crossed by bridges of skin, though the deeper structures are continuously divided ; the condition is due to the knife having jumped over a fold of skin, and is more likely to occur in situations where skin is loose and freely movable. In a case of suicidal cut throat, two broad bridges of skin produced an appearance of multiple wounds and caused the case to be looked on as homicidal, until the post-mortem examination clearly showed the singleness and suicidal character of the wound ; the deceased was an elderly man, the skin of the neck was in loose folds, tough and thickened by exposure.

In parts of the body where the skin is stretched and separated from the underlying bone by a layer of tissue comparatively thin and of uniform structure, the blow of a blunt, smooth object, or a fall, may cause a wound presenting an appearance closely simulating an incision. Wounds of this character are often seen on the scalp and on the malar prominences, caused by a blow of a stick, or stone, or of the clenched fist, or by a fall on a smooth surface. If seen soon after production, before any inflammatory changes have taken place, careful examination shows that the edges are irregular, and the floor uneven, bridged by bands of fibrous tissue and blood vessels.

In a case which occurred a few years ago, a policeman alleged that he was trying to arrest the driver of a carriage and jumped on to the box to seize the reins ; the driver drew out a knife and struck him on the right side of the head, the force of the blow caused him to fall backwards on to the road. When he got up he was bleeding profusely, and found that his right ear had been cut off. He went to hospital, where he was admitted, his statement was taken down, and a certificate given that the injury was caused by a knife, or similar cutting instrument. The driver was arrested very soon after the occurrence and denied having used a knife, or having struck a blow ; he stated that when the policeman jumped on to the carriage he whipped up the horses and the policeman fell off. A second medical man was requested to examine the policeman ; the severed ear, which was discovered in the morning on the road, was sent for inspection, it had evidently been trodden on, the edges were frayed and ingrained with mud, it consequently gave no assistance. On examining the injured man the wound was found to be uneven, its surface nodular, and in places, there were small tags of skin hanging from the edges. The opinion was given that the appearances did not support the statement of the policeman, who, sometime afterwards admitted that the story of the knife was untrue, made up to get the driver severely punished for being the cause of the loss of the ear.

A piece of broken crockery, or glass or a sharp stone, if used with a cutting motion, will cause an incised wound, but falling on objects of this kind will produce a wound with contused edges and very often fragments of the object are broken off and remain in the wound.

The importance of an incised wound depends on its position, size, depth and the structures involved; a clean skin-cut usually heals rapidly, and the scar is linear and movable. If large vessels are divided, death may occur rapidly from hæmorrhage and shock. Deep wounds may be followad by temporary or permanent loss of function of important organs or structures.

PUNCTURED WOUNDS.

Punctured or stab wounds are produced by pointed weapons used with a stabbing movement; knives, daggers, swords, spears, pointed iron rods, pointed sticks, or other objects with a sharp point are commonly used in stabbing cases.

The orifice of a stab made with a sharp pointed knife is clean cut, gaping slightly in the centre, the ends terminating in acute angles; its size depends partly on the width of the blade, but more on the way the weapon was used. If plunged in and withdrawn without any cutting movement, the orifice will be about the size of the width of the blade, or smaller, the latter is especially likely to be the case if the knife was blunt, and consequently stretched without dividing the skin, which would contract when the blade was withdrawn. As a rule, owing to a cutting motion being given to the weapon or to the movement of the wounded person, the orifice of a stab is larger than the width of the blade.

Stabs made with a pointed cylindrical instruments, such as an iron rod or a stick, are slit like, not round. The skin and tissues are split; the direction of the cleavage varies in different parts of the body, and may differ in the skin from the tissues beneath, thus in the arm over the biceps a thrust of a pointed rod produces a vertical slit in the skin and a transverse opening in the tissues beneath. This fact may be of importance and may serve to decide whether a stab was caused by a knife or a pointed rod or stick.

In a stab made with a single edged knife, as a rule, the extremities of the orifice exhibit no difference by which the direction of the cutting edge can be ascertained, but if the back of the blade is thick and not rounded, the wound will be somewhat wedge shaped with the base slightly forked. The importance of a punctured wound depends on its situation, depth and size; the prognosis should always be guarded, as it is impossible in the living, to accurately determine the extent of the injury. The amount of visible bleeding may easily deceive; a small quantity of blood may be discharged from the orifice while fatal or severe hæmorrhage is going on internally.

Lacerated Wounds.

Lacerated wounds are caused by objects which tear the tissues, or by falls. They are characterised by irregularity in shape, a jagged condition of the margins, portions of skin and tissues may be partly or completely detached; the surrounding tissues are often contused and swollen. A marked feature is the small amount of bleeding, even when vessels of considerable size are involved; the arteries being torn, the blood is entangled in the ragged edges and coagulates immediately, preventing further loss. As a rule, the blood does not spirt from the torn vessels, but in those situations referred to when considering incised wounds, the arteries are often divided cleanly and the blood spirts from them; thus, a man struck with a lathi came to hospital within a few minutes and when the cloth he had tied over the wound was removed blood spirted from the divided artery. The wound was on the left side of the forehead about an inch above the external angle of the orbit, directly over the temporal ridge. At the trial the defence set up was that the accused and the injured man were having an altercation over money matters, in the course of which, the latter making a rush at the accused, slipped and the wound was due to the fall. Against this statement, apart from other evidence, there was absence of dust or grit in or about the wound and of any marks of a fall on the person of the injured man, which would probably have been present if he had fallen, as the dispute occurred in a road covered deeply with dust.

Though generally characterised by a small amount of bleeding, death by hæmorrhage may occur in lacerated wounds involving large vessels or vascular tissues; laceration of internal organs is usually fatal from hæmorrhage, and lacerated wounds of the external female genitals due to kicks, the thrust of a stick, or accidentally by sitting on a broken chamber-pot, cause profuse and not infrequently fatal bleeding.

When wounds are found in a dead body, their ante-mortem or post-mortem origin must be determined; as a rule the question is decided without difficulty, doubt is only likely to arise in regard to small wounds, inflicted immediately after death, while the tissues retain their vitality and the blood is fresh.

An incised wound made after death differs from one caused during life, in the absence of gaping and of arterial hæmorrhage, bleeding may occur, but it is venous only and small in quantity, unless a large vein is divided, and even in that case the amount is not great, except when from the position of the body the flow is aided by gravitation. The blood remains fluid or forms small soft clots; the edges of the wound are not injected and there are no signs of tumefaction or inflammation. In a wound inflicted immediately after death gaping may occur, but the retraction is much less than in a wound of the same kind in a living person. I have not had the opportunity of making an experiment immediately after 'death, but in a body dead about half an hour, a transverse incision on the front of the thigh cutting across the muscles, resulted in hardly any gaping and only a few drops of blood oozed from the divided veins.

In another body, death due to cholera, muscular irritability was marked, the muscles of the limbs were contracting at irregular intervals, producing distinct movement of the fingers and toes, especially of the thumbs and great toes, incisions across the contracting muscles resulted in slight gaping during the action of the muscle, in the interval the edges fell together. These observations were made two hours after death.

When a corpse is discovered with wounds on it, the amount of bleeding, the direction of the blood-flow, the distribution of the blood on the clothing and surrounding objects should be carefully noted. A large quantity of blood, firmly coagulated, widely distributed over the body and surroundings, marks of arterial spirting and signs that the blood flowed against gravity are decisive proof that the wounds from which the blood came, were inflicted during life.

The following case illustrates these points:—The dead body of a man was discovered in a room for which he had paid rent for one week, two or three days previously. Nothing had been disturbed when I entered the room. The deceased was lying at full length on his back on a sleeping mat, the head rested on a book, the left arm was slightly bent and the left hand lay on the abdomen. The right arm was stretched along the side, close to the hand there was a blood stained razor. The right hand was covered with blood, back and front, and between the fingers. There were splashes, large and small, and spirts of blood on the forearm and arm. These spirts and splashes were all directed towards the elbow, showing that the arm was bent when they fell on it. The left hand was unstained, and there was only a small quantity of blood on the left arm. There was much blood in large splashes and spirts on the front of the body, and a few spots on the thighs. Behind the neck there was a large mass of blood which had flowed on both sides of the neck, and had spread out over the mat and floor. There were marks of arterial spirting on the floor, the furthest was thirty inches from the wound on the neck. The wound was single, deep, gaping widely, high up, extending obliquely from left to right, the beginning was tailed, the end was also tailed and notched. The throat was opened in the thyro-hyoid space, the posterior wall of the pharynx was notched. The wound was deepest on the left side, the internal jugular vein was opened, branches of the superior thyroid artery divided, on the right side a large vein, apparently the anterior jugular of unusual size, was opened. The wound gaped, the sterno-hyoid muscles, which were cut across, had retracted out of sight, the tissues were injected. The blood formed large coagula.

Punctured and lacerated wounds produced after death show no sign of vital reaction, nor of tumefaction and swelling. The tissues are not injected. The character of a stab wound can be made out by examining the orifice which, if it was caused during life, exhibits the appearances seen in incised wounds.

As a rule, no difficulty is experienced in distinguishing a wound caused during life from one produced after death; the only cases in which doubt is likely to arise, are in regard to small wounds on dependent situations, for example a small wound on the back of the head. Owing to the usual position of a corpse, gravitation of blood takes place after death into the back of the head, and considerable bleeding may take place from a wound in this situation. Gravitation also leads to the distention of the veins and capillaries and produces an appearance of injection. Moreover, bleeding from a vital wound may continue after death owing to gravitation and vital extravasations may be considerably increased. Careful inspection of the edges of the wound, after washing the surface, will enable the distinction of vital from post-mortem origin to be made; post-mortem effusions on the surface of the wound can be readily washed away.

GUNSHOT WOUNDS.

The medico-legal investigation of wounds produced by fire-arms is often attended with much difficulty, owing to the great differences in the effects of projectiles according to their size, shape and momentum, and to the action of powder gases and flame, when the weapon has been discharged close to the body.

Gun-shot wounds have the characters of contused lacerations; if the force or momentum of the bullet is nearly exhausted when it strikes the body, the result is a bruise only, without breach of surface, when somewhat greater force is present, the bullet penetrates and lodges in the tissues; modern weapons, rifles and revolvers impart enormous force to the bullet, which can pass through the thickest bones, moreover the effective range of these weapons, especially rifles, is very great.

In investigating gun-shot wounds, we have to consider the wound of entrance, the track, and the wound of exit; the latter is not always present.

The appearances of the entrance wound depend principally on the distance of the body from the weapon fired. If the discharge took place close to the body, the entrance wound is the result of the projectile, the wad, the powder gas, and flame. The combined effect of these factors may result in a wound out of proportion to the calibre of the weapon and sometimes of enormous size. The wound is a more or less circular opening due to loss of substance, with tears extending from the margin, producing an angular or star shape appearance ; the edges are undermined, this and the star shape are especially likely to occur when the wound is situated over bone, the powder gas carried in through the opening is confined between the bone and the skin, undermines the latter and tears the margin of the hole made by the bullet. The powder flame singes the hair, burns the skin and clothing, the subsequent drying of the burnt surface results in the production of a zone of parchment-like consistency and circular form, around the wound. Not infrequently, especially in wounds produced by bullets of moderate momentum, two zones are found around the orifice—an inner, narrower and darker, and outside it a broader, lighter coloured zone due to the action of the flame. The inner, narrower and more contused looking zone is produced in the following way :—The bullet striking the surface pushes the skin inwards, in front of it, in the form of a cone, the apex of which it punches out, leaving the base abraded and contused by the pressure. This inner zone, the result of pressure of the bullet on the elastic skin is very marked in wounds due to a bullet fired from a weapon at a long distance from the body, and more especially when the bullet is spherical. It has been mistaken for the effect of flame, but the surface is darker and distinctly contused. The elasticity of the human skin, especially of the cuticle, is extraordinary, as the following instance shows :—A a man was shot with a Lee-Metford rifle from a distance of fifteen to twenty feet, the bullet entered the chest on the left side, the entrance wound presented a clean punched-out appearance, but on examination a narrow, about one-thirty-second of an inch wide, finely serrated fringe of cuticle was found inverted round the orifice, showing that even when struck by a conical bullet discharged at a short distance from a modern rifle, the cuticle stretched before giving way. The bullet went through the chest, perforating one rib, the lungs and heart, and passed out on the right side. The exit wound was very like the entrance, a clean punched-out margin, slightly bruised, but there was no fringe of cuticle. After leaving the chest the bullet struck the right wrist producing a wound, the exact reproduction of the entrance wound of the chest, with a similar fringe of inverted cuticle ; the radius was broken across, there was no loss of substance on its front side but from the posterior surface, a large piece of bone was detached and broken into fragments which lacerated the muscles and skin. The bullet was found imbedded deeply in the frame of a table.

When a weapon is fired close to the body, the margin of the wound and the surrounding surface are blackened by the powder gases and speckled with grains of half burnt powder which are driven into the tissues.

The explosive effects produced by the powder gases in wounds are only found when the muzzle of the weapon was very close to the body ; blackening and burning also indicate nearness of the weapon but their range is farther than that of the powder gas. When undermining and bursting of the margin of the wound, and burning and blackening are present, the opinion that the weapon was discharged close to the body may be given with confidence, but the absence of these signs does not prove that the bullet came from a distance ; cases have occurred of suicide, in which the muzzle of the weapon must have been close to the body yet the wound showed no trace of the action of the powder gases nor of burning or blackening. The determination of the distance at which the weapon was fired, is often of the very greatest importance. Assistance may be obtained by experimenting with the weapon, using the same kind and quantity of explosive, the same kind of bullet, but the results are very uncertain and only a very guarded opinion is justified. The point to be kept in mind is that the signs usually present when a weapon is discharged close to the body may be absent.

When a wound is caused by a bullet from a weapon beyond the range of the action of the powder gas and flame, its appearances depend on the shape and size of the bullet and its momentum. A large bullet, other conditions being equal, causes greater damage than a small one. The shape of the wound is generally circular, but if the bullet strikes the body obliquely, it is oval or may take the form of a long furrow before passing into the body. A spherical bullet striking the body at a right angle, produces a circular opening, with inverted edges, often, also ragged with tags of adhering skin. The opening is smaller than the bullet, this is due to the elasticity of the skin which stretches in front of the bullet before giving way. As already mentioned a zone of contused skin which when dry has a parchment-like consistency, surrounds the orifice. A conical bullet, also, generally causes a circular opening, but sometimes the entrance has the shape of a slit, resembling a stab for which it has been mistaken. The opening is smaller than the bullet owing to retraction of the skin, but, if discharged from a short distance, as in the case mentioned, so that its momentum is not diminished, the conical bullet makes an opening of its own size or very little smaller. The momentum of a bullet from a modern rifle continues undiminished for a very long distance and, at fifteen hundred or two thousand yards, is sufficient to pass through a man.

When a bullet strikes a tense part of the body with a layer of fat beneath the skin, protrusion of the fat through the opening commonly occurs, and an appearance of eversion may be produced; putrefaction may also cause eversion of the edges of an entrance wound.

The track of the bullet is also influenced by the distance of the weapon; if close to the body, it is blackened and torn by the powder gases. If the wound is into a closed cavity with rigid walls, such as the skull, the contents and the walls are shattered; a man was found dead in a room, close to the body a Derringer pistol; in the centre of the forehead, there was a circular opening with several tears extending from the margin, which was undermined. The wound and the surrounding skin were blackened and had the smell of burnt powder. In the frontal bone there was a circular opening, three-eighths of an inch in diameter, with numerous lines of fracture radiating from it, many parts of the skull were loose, held together by the pericranium, the brain was completely shattered; the bullet was found at the back of the skull, very little distorted. The smell of burnt powder was present in the brain substance along the track of the bullet.

In the case of a man who committed suicide with a ·500 bore express rifle, the entrance wound, situated in the middle line, one inch below the point of the sternum, was circular, three-quarters of an inch in diameter, punched out, the margins blackened and the skin burst for a distance of two inches. The track of the bullet was scorched and blackened, the stomach was smashed into pieces, the liver and spleen were ruptured, the heart was shattered, the left lung was torn and pieces detached, the 4th, 5th, 6th and 7th right ribs were broken close to the sternum, the 3rd, 4th and 5th right ribs were also broken behind near the spine, all the ruptured organs were blackened, the chest and abdomen were filled with blood.

The effect of the powder gases is well seen in these two cases, in contrast with them, two cases in which the weapons were fired from a distance beyond the range of the powder gases, may be briefly described. A man shot during a riot with buck-shot, one pellet struck the left temple making a circular opening in the skull, three-sixteenths of an inch in diameter in the outer table, from the inner table a larger piece of bone, fully three-fourths of an inch in diameter, was detached. The pellet passed through the brain and lay against the right occipital bone. There was a considerable effusion of blood over the brain and along the track of the shot. The other case has been already mentioned in describing the appearances of wounds of entrance, the man was shot with a Lee-Metford rifle fired from a distance of fifteen to twenty feet, there was a hole in each lung, the base of the heart was wounded, the right ventricle and pulmonary artery opened ; the wound in the heart presented a ragged torn appearance.

The spherical bullet discharged from a smooth-bore gun had little penetrative power compared to the conical bullet used in modern rifled weapons, and if it came in contact with a strong bone was generally stopped or deflected. The conical bullet has enormous penetrative power and passes through the thickest bones which are usually extensively splintered, but in soft cancellous tissue, it may only punch a hole of its own size. The composition of the bullet is an important factor in regard to the effects produced; a bullet made of soft lead, striking a bone, is flattened, set up, or mushroomed, consequently in its further course it causes a greatly enlarged wound with much tearing of the tissues, the damage may be so great as to give rise to the belief that an explosive bullet had been used. The bullets for rifles are made of lead, inclosed in hard metal case.

Pieces of clothing, buttons, coins, or other substances may be carried into the wound, by the bullet. Wads, or pieces of paper used for the same purpose, may be found in the wound, they should be carefully examined and preserved, most valuable information has been obtained from them. The presence of wads shows that the weapon was discharged within a short distance of the body.

The track of a bullet may be extremely circuitous, the aperture of exit may be close to that of entrance, the bullet may pass almost round the body ; a bullet may strike the forehead and come out at the occiput without entering the skull. A similar result has occurred in the chest, the bullet passing round the ribs without penetrating the thorax. These results are more likely to occur with spherical bullets discharged from smooth-bore weapons. The modern conical bullet is less easily deflected and has much greater penetrative power.

The bullet may be broken by contact with bone, and pieces may pass in different directions, some lodging in the tissues, others passing out, making several apertures. The wound of exit is generally larger, less regular, more lacerated and contused than the entrance wound. Great differences are found and many exceptions to the general rule. If the bullet, fired from a distance, passes through the body without suffering any material diminution in velocity, the aperture of exit will be of the same size as that of entrance. An example of this was mentioned in the case of the man shot through the chest by a Lee-Metford rifle. But if the force of the bullet is considerably lessened in passing through the body, the exit wound is larger than the entrance, also irregular, lacerated, the edges everted ; fat and other tissues are often found protruding from it. The following is an example :—A man was shot by a bullet from a Martini-Henry rifle, the entrance wound was on the front of the abdomen above the umbilicus and was circular, about half an inch in diameter, with inverted margins. The bullet in its course passed through the left side of the spinal column ; the exit wound was irregularly oval, much contused and lacerated, one inch long, half an inch wide, the edges were everted, and subcutaneous tissues were protruding from it.

When a weapon is discharged close to the body, the size of the entrance wound is affected by the action of the powder gases, whereas the aperture of exit is produced by the bullet only, under these circumstances, the entrance wound may be larger, more lacerated than the exit. The signs of the action of the powder gases will enable the distinction to be made.

In holes in bone, the entrance and the exit are usually easily distinguished, the entrance is smaller, more regular, generally circular ; the exit larger, with splintering of the edges, and often, detachment of large fragments, as is constantly seen in bullet wounds of the skull. Eversion of the edges is very seldom absent from exit wounds, and inversion is commonly found in entrance wounds.

A gun loaded with small shot fired close to the body, produces a wound like that caused by a bullet, but after penetrating, the shot scatter, and some will probably lodge in the body, those that pass out produce a sieve like appearance. If fired from a greater distance, the shot will probably have begun to separate, and will produce multiple wounds, or there may be one large irregular wound with several smaller openings near it. The distance of the weapon cannot be inferred from the character of the entrance wound, modern guns carry a charge of shot, without scattering, a considerable distance. When the point has to be decided, experiments should be made with the gun, care being taken to use the same quantity of powder and shot. Some years ago I was asked to give an opinion on this point, the circumstances of the case were these :—A gentleman, out shooting, had the misfortune to shoot a man who was standing behind some bushes by which he was hidden. The man's friends immediately set upon the gentleman and accused him of murdering their friend, who, in fact, died two or three hours after he was shot. A post-mortem examination was held, and small shot were found in the body, scattered over the abdomen, chest and neck, also in the arms. Some had unfortunately penetrated between the ribs and wounded the heart and lungs. The friends of the deceased alleged that he was shot when standing close in front of the gentleman and that the act was intentional. The wide scattering of the shot showed their statement was false.

In examining a case of gun shot wound, the question of the direction from which the shot was fired must be considered. The position of the entrance and exit wounds and the track of the bullet should be carefully noted, also signs of deflection. The question is often one of great difficulty, and the medical jurist should not hesitate to make known his inability to answer it.

CHAPTER XI.

WOUNDS AND INJURIES OF DIFFERENT PARTS OF THE BODY.

Head.—Contusions and wounds of the scalp are very common as the result of blows or falls on the head ; they are not, of themselves, as a rule, dangerous, but the violence which causes a contusion or wound of the scalp may also produce serious injury to the skull or brain, hence the prognosis should be guarded, more especially as symptoms of brain injury may not appear for a considerable time. The following instance may be quoted :—During a street quarrel a man was struck with a piece of wood, on the left side of the head ; he was knocked down by the blow but got up immediately and, after some delay, walked to the Police thana where he laid a charge against his assailant. From the thana he walked to the Medical College Hospital, a distance of over one mile. At the hospital a lacerated wound of the scalp, down to the bone, was found on the left side of the frontal region close to the vertex. The wound was dressed, and the man walked to a friend's house where he spent the night ; next morning he got into a gharry to go to his uncle's house. During the drive he complained of his head and gradually became unconscious ; he was removed to hospital, where he died in the evening. The post-mortem examination revealed a fracture in the left temple, extending through the middle fossa into the base, and upwards to the vertex. There was a large blood clot between the skull and the dura mater in the left temporo-frontal region, compressing the brain. The scalp wound was situated an inch and a half in front of the fracture with which it did not communicate. During the trial, at the High Court, Counsel commented on the fact that the House Surgeon of the Medical College Hospital had not found out the existence of the fracture, ignoring that the patient, at the time, had no symptoms of brain injury, and that the wound in the scalp was in front of and not connected with the fracture.

When describing the characters of incised wounds, attention was directed to the occurrence of incised-looking wounds in the scalp, from blows with blunt or rounded weapons, and from falls, and the points by which they can be distinguished from true incised wounds.

Scalp wounds, if extensive and deep, generally bleed freely, sometimes dangerously; these wounds, especially those of a contused lacerated character, are particularly liable to erysipelas and other infections.

A blow on the head may cause immediate loss of consciousness from concussion of the brain; it generally passes off soon, may be only of momentary duration, or it may last for many hours, even days; recovery may be perfect, or headache, confusion of thought, even insanity may occur temporarily or permanently. Concussion may cause immediate death; no lesion being discoverable in the brain, though generally, in fatal cases, contusion of the brain substance in the frontal and lateral lobes is found. The exact condition of the brain in concussion is not known; a traumatic reflex paralysis of the blood vessels, and irritation of the important nuclei in the floor of the 4th ventricle by the displaced cerebro-spinal fluid, have been supposed to exist.

A fall or blow on the head may cause contusion and laceration of the brain, with, or without fracture of the skull, and, as a rule, the injury to the brain is on the opposite side; thus, a man slipped and fell, the back of his head came in contact with a stone floor, he was rendered immediately insensible, and died on the following day, without having regained consciousness. On post-mortem examination, a large bruise in the scalp was found on the left side of the back of the head, and a linear fracture about three inches long beneath it. In the apex of the right frontal lobe there was a large bruise and laceration of the brain substance.

FRACTURES OF THE SKULL.—Fatal cases of fracture of the skull come frequently before medical jurists; many of them are accidental, some are suicidal, and a considerable number are the result of homicidal violence. In all cases, but more especially in those of the last mentioned class, the medical jurist should recollect that his opinion, as to the way in which the injury was caused, and the character of the weapon, will be required. His examination of the head should be careful and complete, the position of all signs of injury on the scalp, brain and skull, their extent and character should be exactly noted. If, at the time of making the post-mortem examination, he has received an account of the circumstances of the case, he should note whether the lesions found are such as could have been caused, in the manner stated, or by the weapon alleged to have been used. Apart from the information supplied, which may be wilfully or unintentionally incorrect and misleading, he should endeavour from the characters of the injuries to determine their causation.

For medico-legal purposes it is convenient to classify fractures of the skull according to their causation. The first division contains fractures produced by violence applied to a small area of the skull, that is, by a weapon of small striking surface ; in the second division are placed fractures, the result of violence acting on a large extent of surface.

Fractures belonging to the first division resemble in shape the striking surface of the weapon by which they were caused ; thus, a blow of sufficient violence, with a hammer, results in a circular fracture which, in the outer table of the skull, is of the same size as the striking surface of the hammer ; from the inner table a circle of larger size is detached. The reason generally given for the more extensive area of fractures in the inner table, as compared to the outer, is that the former is more brittle. This appears not to be the correct explanation. When a bullet passes through the skull, at the entrance, the hole in the inner table is larger than that in the outer, but at the wound of exit, the reverse is found, the hole is larger in the outer than in the inner table. The true explanation probably is that as the bullet penetrates the bone, its force becomes more widely distributed ; in the case of a blow with a hammer the same explanation holds.

The following case is a typical example of a fracture, produced by a weapon of small striking surface :—The deceased, a man of about 40 years, was assaulted, on the 2nd of May 1896, by several persons. He was removed to Hospital where he died on the 13th from erysipelas. On post-mortem examination, two granulating scalp wounds were found, one on the top of the head in front and to the left of the middle line, beneath it, there was a circular fracture, seven-eighths of an inch in diameter, slightly depressed at its lower part. On removing the skull cap, the inner table was found fractured, and depressed over an area of one inch and a half. There was a clot of grumous blood between the area of fracture and the dura mater, the brain substance beneath was slightly compressed. It appeared from the evidence that deceased was assaulted with knobbed sticks. At the trial in the High Court, Counsel for the defence endeavoured to make out that the skull of the deceased was abnormally thin. I had taken measurements of the bone at the site of the fracture and had also kept the specimen which I produced in court.

Not infrequently, the whole of the striking surface does not come in contact with the head, the fracture will in such a case resemble that portion of the surface by which it was caused ; the blow of a hammer may cause a curved fracture due to a portion of the edge only striking the skull.

In fractures of the class now under consideration, the force of the blow is expended on the part struck, and is not transmitted to other parts of the skull though linear fractures may radiate for a short distance from the site of impact. The influence of head coverings, puggris, or thick abundant hair must be kept in view ; they prevent the direct impact of the weapon on the skull, and besides lessening the force, distribute it over a wider area, and consequently interfere with the production of fractures resembling the striking surface of the weapon.

The second division of fractures of the skull comprise those caused by weapons having a large striking surface, or by forces applied to a large area of the head.

Fractures of this class are very common and frequently form the subject of a judicial inquiry, in which the medical man, who made the post-mortem examination, may expect, especially in homicidal cases, to have numerous questions put to him regarding the character of the injuries, the condition of the injured parts, the description of weapon, or the manner by which the injuries could have been produced.

Dr. B. Körber, Professor of Legal Medicine at Dôrpat, has investigated the mechanism of the production of fractures of the skull. His results are published in the " Deutsche Zeitschrift für Chirurgerie " of September 1889. The paper is most interesting, and worthy of careful study by medical jurists and also by practising surgeons. He divides fractures resulting from violence applied to a large surface, into two groups ; the first, those in which the skull is subjected to bi-lateral compression ; the second, those which are caused by violence applied to one side.

1st Group.—Bi-lateral Compression.

When the skull is compressed between two forces, the greatest bulging and tension take place midway between the forces, and if the skull bursts, the fractures occur at these points and extend meridionally towards the parts where the pressure was applied. The greatest separation takes place at the points of origin ; as a rule, the fractures rapidly become linear as they extend towards the seat of pressure on either side. To produce the effect of bilateral compression, it is not necessary that the head should be subjected to two moving forces, the same result is caused if the head is fixed and unable to recede when struck on the opposite side. Thus a blow on the vertex compresses the head against the spinal column, and if the violence is sufficient, causes bursting of the skull midway between the vertex and the base, the fractures extending upwards and downwards. The following example may be briefly quoted. The case was published in "The Indian Medical Gazette" in 1893. A man, standing on the deck of a steamer, was struck on the top of the head by an awning spar, about 15 feet long and 4 inches in diameter, accidently displaced from its rests. He was removed to hospital ; there was a large bruise on the top of the head, and symptoms of compression of the brain; no fracture was detected. It was decided to trephine, and a circle of bone was removed from the right parietal region ; no improvement followed, and the patient died twenty hours after the accident. At the Morgue, I found extensive bruising over the top of the head; on reflecting the scalp, an extravasation in the right temporal region, beneath the muscle, and a fracture running vertically through the temporal bone, traced upwards it ceased to be visible at the temporal ridge. On the left side, an exactly similar fracture of the temporal bone was found, but no extravasation of blood. When the calvarium was removed, it was seen that, although on the outside, the fractures stopped at the temporal ridges, they were continued, in the inner table, upwards to the middle line where they joined, the line of fracture corresponded to the coronal suture. On the right side, there was a considerable quantity of blood-clot between the bone and the dura mater, none on the left side. After removing the brain, the fracture, on either side, was seen to pass through the middle fossa, into the body of the sphenoid, crossing the middle line, though not joining, as at the vertex, consequently a narrow neck of bone held the two parts of the base together. On either side, in the temporal region, a separation to the extent of an eighth of an inch was present, but both upwards and downwards, the fractures rapidly became linear. There was an extravasation of blood in the substance of the brain, about the fissure of sylvius, and a short linear fracture of the base, behind the foramen magnum; the left zygoma was also fractured. In considering the effects of bi-lateral compression allowance must be made for the variations in thickness and strength of different parts of the skull. The base is more easily fractured than the calvarium, and in the temples, orbits and roof of the nose, the bone is thinner than elsewhere. These differences modify the effects of compression.

2nd Group.—Uni-Lateral Compression.

When compression is on one side, as for example, a man receives a blow on the side of the head when standing, his head being free to move under the momentum of the blow, if the violence was sufficient to cause a fracture, the bone breaks at the seat of impact, and the fracture extends in the direction of the force. Most of the violence is expended on the part struck, as is shown by the greater separation of the edges of the fracture and the occurrence of short linear offshoots from it. Beyond the area struck, the fracture rapidly becomes narrowed to a hairlike fissure which seldom crosses the middle line. The following is a typical case of uni-lateral compression fracture. It has been referred to previously to illustrate the slow onset of brain symptoms after injury to the head. It is, therefore, only necessary to describe the lesions of the skull. There was a fracture in the left temple, it ran vertically upwards, to within half an inch of the middle line, and downwards through the middle fossa, ending in the body of the sphenoid. The greatest separation was in the temporal region, about the centre of the fracture, the bones were a line apart, upwards and downwards the fracture rapidly became linear. In the temporal region there were several short offshoots from the main fracture and the margin of the lesser wing of the sphenoid was broken.

An account of this case will be found in "The Indian Medical Gazette" of 1893.

In making a post-mortem examination, in cases of fracture of the skull, the thickness of the bone, at the seat of injury, should be carefully measured, and any peculiarity in the texture noted. A question frequently asked in Courts is, what amount of violence would be required to produce the fractures found ? The question can only be answered in general terms ; the strength of a bone depends on its thickness and on its quality ; the latter cannot be determined, except in rare cases where the texture is manifestly abnormal. In newly born children, the bones of the head are easily splintered, along the lines of the ossifying rays. In young persons, the skull is more elastic than in adults, and therefore less easily fractured. In old people thinning of the vertex is sometimes found and also changes in the texture of the bones of the head. As in other parts non fatal injuries of the head may be followed by grave consequences, mental disorder, epilepsy, paralysis, general or partial.

Injuries of the face are important owing to the disfigurement they cause. Permanent disfiguration of the head or face comes under section 320 of the Indian Penal Code. In this country, cutting off the nose is a frequent method of punishing an unfaithful wife or mistress. The loss of an eye is a serious misfortune; total loss of sight of one or of both eyes may follow an accident, without any change in the appearance of the eye to account for it. Blindness of one eye is sometimes feigned, examination with the ophthalmoscope and testing the vision of the sound eye with a prism will generally lead to detection, unless it happens that the feigner is well up in optics. The external ear is often injured in fights, total loss is not uncommon, cutting off the ears was a punishment for offences in old days. The effect on the hearing is generally not great and may be imperceptible. A blow on the ear may rupture the drum which usually heals, or it may damage the internal ear causing temporary or permanent loss of hearing. Deafness may be feigned, careful watching and testing with a tuning fork will generally lead to detection.

INJURIES OF THE SPINE.

A condition which frequently leads to litigation, is that known as railway spine. It is supposed to be due to concussion of the spinal cord ; in some cases, the symptoms are more cerebral than spinal, and such cases are called railway brain. The condition is not confined to railway accidents ; it may follow a shock, blow, or severe shaking, however caused.

The symptoms exhibit the greatest diversity, and in many cases are subjective only, which causes them to be viewed with suspicion, as simulated with the object of getting heavy damages from the railway Company. Some days or weeks after the accident in which he may or may not have received visible injuries, the patient complains of headache, nervousness, inability to concentrate his attention, sleeplessness, irritability of temper. These symptoms increase and others arise, abnormal sensations in the legs and other parts of the body, the general health suffers, he loses flesh, his mental condition may be greatly altered. Some individuals become hysterical, others exhibit great depression which may pass into melancholia. The duration of the symptoms is prolonged, the prognosis doubtful ; some recover, and the improvement may date from the settlement of their claims, the condition is largely mental, and the symptoms disappear when the patient's anxiety, regarding the compensation due to him from the railway company, is removed. Other cases continue throughout life, amelioration may occur but not complete disappearance of the symptoms. In some cases, the symptoms point to organic changes in the cord and brain, tremor, bladder symptoms, alterations in the field of vision, optic atrophy. Death may occur years after the accident.

The symptoms of railway spine, or railway brain may be simulated, or what is more common, may be greatly exaggerated. Medical evidence will be called on behalf of the plaintiff, to support his account of his sufferings and the effect of the injuries on his health ; and for the defendants, medical evidence is also forthcoming. The following case, reported in the London "Standard," is a typical example :—the plaintiff brought an action against a railway company to recover damages for personal injuries, caused through the negligence of the company's servants. The company admitted negligence, and the only question for the jury was as to the amount of damages.

The facts showed, that the accident happened when the plaintiff was in the last compartment but one of a train standing at a station. It appears an engine ran into the end of the train, the result being that the plaintiff was jerked forwards and backwards several times. On arrival at his journey's end, he became very sick and was medically attended. Becoming worse, a specialist was called in, when it was discovered there was a fracture of the last lumbar vertebra. He was placed in a plaster of Paris jacket, and eventually, was supplied with a specially made felt vest which he was ordered to wear day and night. Plaintiff was brought into Court in an invalid chair, and sat on an air cushion whilst he gave evidence. Doctors A., B., and C., gave evidence to the effect that plaintiff would never be able to work again and must travel as little as possible. A photograph, taken by the X-rays, distinctly showed the fracture of the spine.

On behalf of the company, evidence was given by Dr. Z., who stated he had examined the plaintiff on six different occasions and found him suffering a certain amount of bodily pain, due to severe strain to the spinal column. He had been shown the photograph of plaintiff's spine, but it did not show anything definite to him, and in his opinion did not indicate any fracture to the spine. He saw nothing in the plaintiff's condition to warrant the assumption of a spinal fracture. In his opinion, the plaintiff had had a severe strain, and quite likely some of the ligaments had been torn. He was suffering from functional weakness in almost every organ of his body, due, to a great extent, to mental anxiety, and to his being kept at rest. He believed the plaintiff would recover. In cross-examination witness said he believed the best treatment for the plaintiff would be settlement of this case, and from that moment he would commence to recover. He would like to see him twelve months hence. Even if the bone were fractured it would not make any difference to his chances of future recovery.

Similar evidence was given by Prof. Y. The jury assessed the damages at £ 1,950.

The conflicting character of the medical evidence in this case is extraordinary but not unique, just as contradictory statements are made in most cases in which medical evidence of an expert nature is called by the plaintiff and by the defendant.

Dislocation, combined with fracture of the spine, is a common accident as the result of falls from a height, or from blows. In some of the cases, the violence is of a direct character, more often indirect, as when fracture of the spine is due to a fall on the head from a height. In India, dislocation and fracture of the neck is frequently due to slipping when carrying a heavy weight on the head. This accident is of common occurrence in Calcutta, but of late years few of the cases are sent to the morgue for post-mortem examination, as the accidental character of the death is generally beyond doubt, and the body is disposed of by order of the Commissioner of Police. In these cases, what appears to occur, is that when the man slips, there is a sudden unexpected alteration of the axis of pressure, and the neck is forcibly bent, usually forwards, resulting in fracture of the body of one or more cervical vertebræ and a dislocation of the upper part of the spine forwards. In three cases of this kind, there was dislocation only, no fracture ; in two, the separation occurred between the 5th and 6th ; in one, between the 6th and 7th cervical vertebrae. I have examined seven cases of dislocation of the spine without fracture, five were in the cervical region, two between the last dorsal and first lumbar vertebrae. The cause of three has been mentioned, the other four were due to heavy weights falling on the back.

The following case shows the lesions generally found in fracture and dislocation of the spine from direct violence. A coolie fell through the upper hatchway of a ship into the hold. In falling the body struck against the stringer or beam of the hatch of the lower deck. Eye-witnesses described that the back of the deceased struck the stringer and the body remained suspended on it for a few moments, then slipped feet foremost into the hold which was partly filled with bags of rice. There was a large extravasation of blood in the back at the level of the shoulders, the blood was effused in and between the muscles, the spines and articular processes of the last two cervical and the first dorsal vertebræ were broken. The bodies of these vertebræ were torn apart, there was much blood in the spinal canal, and an extravasation in the substance of the cord opposite the injured vertebræ.

The lesions found in cases of fracture from indirect violence are exhibited in the following case :—A coolie, carrying a heavy package in the street, slipped and fell. He was removed to hospital in an unconscious state and died after thirty-six hours. There was a bruise on the chin, a transverse fracture of the sternum at the level of the second rib, the body of the 5th cervical vertebra was fractured, the upper part of the spine was displaced slightly in a forward direction. There was blood effused around the injured part, and a considerable quantity in the spinal canal. The spinal cord was softened, and discoloured by effused blood opposite the 4th and 5th cervical vertebræ.

The importance of fracture and dislocation of the spine mainly depends on the condition of the spinal cord ; it is generally injured, sometimes torn across, more often compressed and bruised. Death may occur immediately when the cord is injured above the fourth cervical vertebra, owing to the cutting off of the respiratory centre from the phrenic nerves. Death may occur equally rapidly in lesions of the cervical cord at alower level. On the other hand, a patient may survive a considerable time after injury of the cord above the fourth cervical vertebra. The length of time the patient survives depends more on the extent of the injury and its effects on the functions than its position. Injuries of the cord in the dorsal region generally cause death within one or two weeks, but the patient may live for years in a paralysed condition.

INJURIES OF THE NECK.—Injuries due to hanging, strangulation and throttling are referred to elsewhere. Wounds of the neck are of great importance ; cut throat is a common mode of suicide and also of murder. The characters of wounds of the throat will be considered later.

Contusions of the larynx may be caused by blows of all kinds, and by compression. A violent blow on the larynx has been immediately fatal from shock, or from spasm of the glottis. Fracture of the hyoid bone may be caused by forcible compression by the hand. Fracture of the cartilages of the larynx may be produced in a similar manner, or by blows. These injuries are dangerous owing to the risk of spasm of the glottis, swelling and œdema of the mucous membrane, interfering with the entrance of air, suffocation by blood getting into the air passage, and later from inflammation and necrosis of the injured parts.

INJURIES OF THE CHEST.—Contusions of the chest may be caused by blows, falls, pressure and other forms of violence ; they are important chiefly because of the likelihood of simultaneous injury to the thoracic viscera. Broken ribs are very common from blows, falls, compression of the chest, and, very rarely, from muscular action, during violent coughing. The ribs are more easily fractured in the old than in the young, on account of the diminished elasticity and increased brittleness as age advances. The middle ribs are those usually fractured, but in falls from heights all or nearly all the ribs may be broken, generally in the same line on each side. A man fell from a height of 40 feet, his head was smashed, the eight upper right ribs and the six upper left ribs were broken in the axillary line, the left clavicle was also fractured.

Compression of the chest by a great force causes extensive fractures of the ribs. In a man who was jammed between a railway wagon and a wall, the nine upper right and the six upper left ribs were broken, the 2nd, 3rd and 4th right ribs in two places. The lungs were also extensively lacerated. In an elderly woman who was run over by a carriage, the right ribs from the second to the seventh, and the left from the second to the sixth were fractured, in the midclavicular line. The right ventricle of the heart was ruptured, the tear was an inch and a quarter long and parallel to the septum.

Contusion of the chest and fracture of ribs may be caused by kneeling on the chest in strangling or throttling. Chevers drew attention to a mode of torture practised in Bengal, especially in the northern districts, called "bansdola." A bamboo is placed on the ground and the victim laid across it. Another bamboo is put across his chest; men sit on the ends, and roll the bamboo backwards and forwards over the chest. The torture is intense, the muscles are bruised, but if care is taken, no external mark is caused. If great force is used the muscles are pulped, the ribs broken and the lungs lacerated. The torture is also applied in a similar manner to the limbs. I have recently examined the body of a man who, according to the police report, was murdered by the bansdola applied to his neck. The body was in a very putrid condition when examined. There was a ragged opening on the right side of the neck, a very large quantity of extravasted blood was found in the tissues of the right side and front of the neck, the hyoid bone and the thyroid cartilage were broken into pieces. The spine was dislocated between the 5th and 6th cervical vertebræ.

Rupture of thoracic organs may be produced by falls, blows, compression of the chest, without any external sign of injury, and without fracture of the ribs. A child, aged 5 years, was knocked down in the street, and the wheel of a carriage passed over its chest. Death occurred within a few minutes. There was blood stained froth about the nostrils, no mark of injury on the chest, the child was wearing a padded jacket, no ribs were broken, both lungs were ruptured deeply and extensively. In "The Indian Medical Gazette" of 1897 I reported a case of rupture of the heart from a blow with a stick. The deceased survived over three hours, the case is interesting and may be described briefly :—A cooly, aged about 30 years, was struck with a stick, described by an eye-witness to be an ordinary walking stick. He had just finished his evening meal, and, on receiving the blow, vomited, complained of severe pain, and appeared so ill that the people of the house removed him to the Medical College Hospital where he died about three hours and ten minutes after the blow. There were some small abrasions on the body ; on the left side of the chest, below and inside the nipple, there was an elliptical abrasion, 2¼ inches long, ¾ of an inch wide, directed obliquely downwards and inwards, over the 4th and 5th ribs. The skin in the centre of the abrasion was intact ; in the tissues beneath there was a small bruise. The stomach was greatly distended ; its contents, rice and fluid, measured 48 ozs. The pericardial sac was filled with partly clotted blood, 14ozs. were measured. The heart was contracted, there was a small, irregular shaped rupture in the apex, communicating with the right ventricle. The muscle fibres appeared quite healthy; the wall of the right ventricle was of usual thickness, except at the apex, where at the site of the rupture the layer of muscle was very thin—much thinner than in another heart examined at the same time. It appeared to be of the thickness of stout brown paper.

In a man, on whom a bale of jute, weighing 400 lbs. fell from a height of about 12 feet, I found some small abrasions on the back, a simple fracture of the left femur, a rupture of the liver nearly separating the right from the left lobe, and a deep tear in the posterior surface of the left lung, near the root; no rib broken.

Broken ribs may penetrate the lungs causing lacerated wounds which, if extensive and deep, are generally fatal within a short time. Air may escape from the wounded lung into the pleura, and may make its way into the tissues of the chest wall and thence over the body generally. In a man who fell into the hold of a ship, and died in about an hour, the 1st and 2nd left ribs were broken, the left lung was wounded by the broken end of the first rib, the whole body was swollen from emphysema which extended in the arms to the hands, in the legs to the knees; the face, neck and back were also emphysematous.

Wounds which penetrate the chest are always dangerous, and often rapidly fatal, yet the recorded cases show that recovery may follow perforation of the chest by a bullet or by a sword. Wounds of the heart, especially if a cavity is opened, are, as a rule, rapidly fatal, but there are many recorded cases of survival for several hours and also of recovery. Within the last few years, cases of successful surgical treatment of stab wounds of the heart have been reported. Even when rapidly fatal, a wound of the heart does not at once disable the person and prevent him from doing various acts. In 1894, I examined the body of a man, killed by a wound of the heart. There was a stab on the left side of the chest, the knife passed through the left ventricle, in the front wall, the wound was $\frac{3}{4}''$ long, and $\frac{1}{8}''$ on the posterior wall. The wound was about an inch from the auriculo-ventricular groove. There were 44oz. of blood, measured, in the left pleura. It was stated in the police report and confirmed by the evidence of eye-witnesses, at High Court, that the deceased, who was stabbed in a room, called out, and walked from the room across a yard, laid down on a stretcher and died.

The recorded cases show that persons who have sustained more extensive wounds than in the case mentioned, have performed various acts, and even after a bullet has passed through the heart, the individual has performed acts requiring considerable strength. The following case reported by Lewis Balch is an instance:—"A farmer, named Briggs, was arrested for killing a man named Woods employed on his farm. Briggs, having had his suspicions aroused concerning the relations of his wife and Woods, determined to investigate, and, stating he would go away for a few days, left his farm. He returned secretly in the night, and entered the general living-room by means of a window. Off this room, opposite the window by which he climbed in, were two small rooms, one of which was occupied by Mrs. Briggs. The door of this room was open, and was also the nearer to the door leading into the front hall. The weather being warm, this hall was only closed at the house front by a sash-door fastened by an ordinary cast-iron bolt, one inch wide by one-eighth of an inch thick. Briggs advanced to about the centre of the living-room, from where he could command a view of the bed in his wife's room. Some slight noise made by him caused a movement by an occupant of the bed, and Briggs, his suspicions now converted into certainties, raised his pistol and fired. Woods sprang from the bed and the room, turning into the front hall. Briggs fired another shot, and then changing his position by advancing so as to command the hall, fired again. Woods had by this time reached the sash-door, and not waiting to draw the bolt he threw himself against the door, breaking the bolt squarely in two, and continued his flight down the slight hill on which the house stood, to the nearest cottage, about a quarter of a mile away where he fell at the door groaning. His fall and groans aroused the inmates who got up, opened the door, and were considerably surprised to find a man without a stitch of clothing on him lying on their doorstep. Woods was carried into the cottage and put to bed. On the third day he died.

"The autopsy disclosed the gunshot wounds, one through the fleshy part of the inside of the right arm, another grazing the right side, about on a level with the wound in the arm. Both of these were clearly made from behind forward and neither was a dangerous wound. A third wound of entrance, oval in shape, was found on the left chest in the third intercostal space, penetrating the cavity. On opening the chest the right cavity was found full of blood, right lung compressed to its smallest extent, left lung normal.

"The track of the ball was clearly marked by a red line, and led to the pericardial sac, into and out of the right auricle, across the lower edge of the right pleural cavity at its internal angle, through the diaphragm into the liver, which it traversed, and was found lying in the fat and areolar tissue near the gall-bladder. Brain and other organs were healthy, and no other cause of death except the pistol wound was found.

"The evidences here presented by the wounds alone were most important. The prisoner claimed he had shot Woods as he was in the act of rising from the body of Mrs. Briggs, and as Woods ran down the hall he had fired at him twice. The wounds in the right arm and side were probably these last two shots, they showed clearly the bullets had passed from behind forward. The fatal wound could only have been received in two ways, either as claimed by the prisoner, he standing, Woods nearly horizontal, or from above, the wounded man being erect. Of this there was no evidence, there being no doubt that Briggs entered the room from the window and that he fired from about its centre. The ball nowhere touched bone, was not upset, showed marks of the 'lands and grooves' in the rifling of the barrel, had made a straight line in the body, and gone as far as it had the power. It was of ·36 inches calibre, the pistol being a large one."

Balch advised the district attorney that the evidence of the fatal wound substantiated the statement of the prisoner. Briggs was convicted of manslaughter.

At the trial of the case of stab through the heart previously mentioned, among other questions, I was asked: Could the deceased have spoken? Could he have walked from the room where he was stabbed across the yard? To both, my reply was in the affirmative, neither the larynx, nor the parts engaged in articulation were affected, and as regards the second question, the recorded cases show that much larger wounds do not always produce immediate disablement.

Wounds of the great vessels of the chest are almost as dangerous as those of the heart and nearly always rapidly fatal. Recovery is not impossible.

INJURIES OF THE ABDOMEN.—Death may be caused by a blow on the abdomen. No sign of injury may be found and the post-mortem examination may be entirely negative. In cases of this description, death is due to cardio-respiratory inhibition or shock. The opinion as to the cause of death can only be inferential, based on the absence of lesions, ascertained by a complete post-mortem examination, and the history of the case.

A violent blow, a kick with the booted foot, the passage of the wheel of a heavy vehicle over the abdomen, may leave no external mark of injury and no bruising of the abdominal wall, although the violence caused rupture of viscera ; the elastic tissues of the wall recede from the blow, the force of which is expended on the internal organs, particularly the solid structures. In some cases, marks are found on the skin, they are more likely to be present if the part was unclothed, but, even in this case, a kick with a boot does not always cause a mark on the skin. The skin of individuals who habitually go about with no clothing, except a loin cloth, becomes, from exposure, tough, and is not easily abraded. In some cases, bruises which may be extensive, are found in the deeper layers of the abdominal wall when no sign of injury is apparent externally.

Penetrating wounds of the abdomen are always dangerous, especially those involving viscera. Death may result from shock, or hæmorrhage, or later, from peritonitis.

Rupture of abdominal viscera is usually caused by great violence, falling from a height, heavy objects striking the abdomen, the wheel of a cart passing over the body, blows with lathis or heavy clubs ; but in India, the medical jurist frequently meets with cases of rupture of enlarged spleens from very slight violence, a push, a slap with the open hand ; and in some cases, rupture takes place spontaneously, without any kind of violence having been used.

Rupture of the liver is an injury, as a rule, rapidly fatal, and generally complicated with other injuries. Among a large number of fatal accidents examined in the Calcutta Morgue during a period of $7\frac{9}{12}$ years, only 5 cases of rupture of the liver alone were met with. One of these is of interest, as the deceased survived $8\frac{1}{2}$ hours. A boy, aged 5 years, playing in the street, fell and the wheel of a conservancy cart—heavy iron vehicle—passed over his body. He was taken to hospital but his mother refused to keep him there, and brought him back to her hut where he died $8\frac{1}{2}$ hours after the accident. On post-mortem examination, no sign of injury and no mark of the cart wheel were visible on the body ; in the subcutaneous tissues, over the right rectus abdominalis, there was a small bruise. The abdomen contained 16 ozs. of blood. There was a laceration filled with blood clot on the anterior edge of the left lobe of the liver ; it was about one inch deep. On the under surface of the liver there was a small tear, also filled with clot, no other injury in the body. Doubtless the clotting of the blood in the lacerations stopped further bleeding and accounts for the long survival.

Rupture of the Spleen.—In India, rupture of the spleen is of considerable medico-legal importance ; in malarious parts of the country enlargement, often enormous, is common, and the organ in its diseased condition may be extremely friable and easily lacerated by the slightest violence. During $7\frac{9}{12}$ years, at the Calcutta Morgue, 7 cases of rupture of the spleen alone, without the slightest sign of injury elsewhere, were examined. Of these, in three the rupture was spontaneous ; the particulars of these three cases may be briefly described. In June 1894, a man, aged 30 years, passenger from Rangoon, seated, talking to friends, on the deck of a steamer coming up the River, suddenly complained of severe pain in the abdomen, laid down on the deck, and became collapsed. He died soon after the steamer arrived, a few minutes after he had been carried on shore, about $1\frac{1}{4}$ hours after he felt the pain in his abdomen. There was not the slightest mark of violence on any part of the body. The abdomen contained 44ozs. of blood. The spleen was ruptured at the centre of the inner surface, the capsule was thin and separated from the spleen pulp around the site of rupture by a large mass of blood clot. The laceration was two inches long, and deep into the spleen pulp which was extremely soft and friable. The spleen weighed 2lbs. 2ozs.

The second case was examined in September 1895. An up-country Hindu came to Calcutta to visit relations, and was squatting on the ground, talking to his friends. He complained of feeling very ill, and died within a short time. I found the abdomen full of blood, 34 ozs. were measured. The spleen, very large, soft, friable, with a thin, tense capsule, was ruptured. There was a laceration of the capsule on the inner and upper surface, a large quantity of blood clot between it and the spleen pulp, in which there was a deep rupture at the lower part of the inner surface. The spleen on removal from the body weighed 2lbs. 12ozs., the mass of blood clot under the capsule was carefully removed and the spleen weighed again ; it was now 1lb. 14ozs. and measured 8″ × 6″ × 2″. The third case, examined in November 1896, is very similar. A man, about 40 years, while seated, suddenly became faint and unconscious, and died within a few minutes. No mark of violence, abdomen contained 66ozs. of blood, spleen, weighed 1lb. 1oz., measured $8\frac{1}{2}''$ × 5″ × 1″, showed a small rupture in the capsule on the inner surface, and a large laceration of the spleen substance which was extremely soft and friable. The rupture in this case was evidently central, the branches of the splenic artery had a mottled appearance, probably an atheromatous change.

In these three cases a very careful inquiry was made, and they may be accepted as examples of spontaneous rupture of diseased spleen. The following case of rupture from slight violence is interesting. The deceased, a Mahomedan boatman, walking along a gangway, slipped and fell forwards on his face. He was taken to hospital in a state of collapse, and died 6 hours after the fall. On post-mortem examination the only external mark of injury was a minute bruise over the left hip. The abdomen was full of blood, 100 ozs. measured ; the spleen was very large, soft and friable. There were two ruptures in the outer surface of the capsule, and some distance from them a large deep laceration of the pulp, much blood between the capsule and the surface of the spleen, which measured 10″ × 7″ × 2″, weight 3lbs. $3\frac{1}{2}$ ozs. In another case, the deceased was struck with the clenched first and died within a few minutes.

On post-mortem examination, no mark of violence was found, the abdomen contained over 100 ozs. of blood, the spleen was enlarged, weight 2lbs. 6 ozs., measurements $7\frac{1}{2}'' \times 4\frac{1}{2}'' \times 1''$. There was a rupture at the hilum 3″ long, 1″ deep. The accused was charged before the Magistrate, who after hearing my evidence and taking my opinion regarding the violence required to rupture a spleen of the character of that found in the deceased, convicted him of the minor offence.

In all the cases of rupture of the spleen, from slight or considerable violence, the organ was enlarged, usually greatly, the capsule thin and tense, the substance soft and friable ; in chronic malaria the enlarged spleen "ague cake" has, as a rule, a thickened capsule, often presenting large white plaques of dense fibrous tissue, the substance also is tough, fibrous, and of a brownish or yellowish brown colour. Rupture of a spleen of this description would only occur from great violence. But an "ague cake" may, in consequence of an acute attack of fever, become distended with blood, soft, friable, and easily ruptured.

Rupture of the stomach alone is a very rare injury, not a single case was met with in the Calcutta Morgue during $7\frac{9}{12}$ years, nor in the 9 years referred to by Mackenzie. I met with one case of rupture of the stomach combined with other injuries :—An elderly woman was knocked down and the wheel of a heavy carriage passed over her body, causing a comminuted, compound fracture of the left arm, fracture of the 9th, 10th and 11th left ribs, a small laceration of the left lung, complete crushing of the upper part of the spleen which was enlarged, and a laceration through the anterior wall of the stomach at the cardiac end ; the tear was two inches in length and ran in the long axis of the organ. The abdomen contained 50 ounces of blood mixed with food.

Spontaneous rupture of the stomach has been recorded, it would probably occur only from great distention and in diseased conditions of the organ.

Bruises of the walls of the stomach and extravasation in the mucous coat were found in several cases of poisoning, apparently caused by energetic pressure, in endeavouring to expel the contents through the tube of the stomach-pump.

Rupture of the intestines is generally combined with other injuries. Mackenzie mentions eleven cases of uncomplicated rupture of intestines, met with in nine years. During $7\frac{9}{12}$ years, I examined only three cases of rupture of the intestine alone :—One was the case of a man struck on the abdomen by a capstan bar. He and others were engaged in heaving up the anchor of a flat when the catch broke, and the capstan reversed suddenly, the bar struck the deceased a violent blow. He was knocked down but got up immediately, and though he complained of pain in the abdomen, went about his work. The next day, about twenty-four hours after the accident, he ate some dâl and rice, which he vomited an hour later, and died very soon after. There was no sign of injury on the abdominal wall. On opening the abdomen, acute general peritonitis was found, the mesentery was bruised and there was a laceration of the small intestine about half an inch long, through which the contents of the bowel had escaped, and also a round worm. The case is peculiar in the length of time that elapsed between the injury and the onset of serious symptoms. The fact that he went about his work and on the following day took food, shows that he felt no great pain.

In a somewhat similar case, a man was struck by an iron bar which was being hoisted and suddenly swung round, death took place on the seventh day. There was a granulating non-penetrating wound below the umbilicus. The abdomen contained fœtid purulent fluid and fœcal matter. There was general peritonitis, the intestines were matted together by exudation ; there were bruises on several portions of the small intestine, and in some of the bruises perforation of the wall had occurred.

The other case is of considerable medico-legal interest :—A woman, 55 years of age. The police report states that on the 10th of December, 1898, the deceased was assaulted by some of her neighbours, " a man is said to have kicked her with his bare foot in the stomach," and two women " to have dragged her by her hair and thrown her down." She died at 7 A. M. on the 13th. When the police went to investigate the case, which was not reported until after the woman's death, they found her thumbs tied together with string, also her great toes. The husband stated he did this before her death "to prevent her struggling." The post-mortem was held at 7-30 A. M. on the 14th, about 24 hours after death. The thumbs and great toes showed marks of the string with which they had been tied. The abdomen was slightly swollen and there was a faint tint of green discoloration at the sides. A large quantity of purulent fluid mixed with fæcal matter escaped on opening the abdominal cavity, there was acute general peritonitis, intestines adhering to each other and to the abdominal walls. At the junction of the jejunum and ilium, there was a perforation of the bowel ½" long, close to the mesenteric attachment, the edges were clean, regular, congested slightly at one part only. There was a round worm loose in the peritoneal cavity and another half in the right Fallopian tube, both the tubes were patulous. There were no bruises in the abdominal wall, peritoneum, mesentery, or in any part of the body.

Rupture of the intestine usually occurs at the commencement of the jejunum. The large bowel is rarely ruptured, Mackenzie found rupture of the caecum in one case, and of the jejunum and sigmoid flexure in another.

Rupture of the kidney is a less fatal injury than rupture of the organs previously considered, as it lies behind the peritoneum, and rupture may take place without involving the latter.

Mackenzie mentions one case of uncomplicated rupture of the kidney, combined with a fracture of the right femur, the right kidney was torn into three pieces. The following case was examined in 1896 :—A girl was squeezed by the wheel of a carriage against a wall, death took place 9½ hours after the accident. There were the following injuries, a compound fracture of the right ulna with considerable bruising of the forearm and arm, extensive abrasions of the right side of the chest, small bruises on the legs, a small lacerated wound of the scalp on the back of the head. Around the right kidney there was a large mass of blood, the organ was torn across, the portions joined only by the tissue of the pelvis. The bladder contained half an ounce of blood clot.

In several cases of crushing of the body by heavy packages, railway wagons, etc., rupture of the kidneys was found combined with extensive injuries and ruptures of other organs.

Rupture of the bladder can only occur when the viscus is full, and in this condition may follow from slight violence. There are many cases on record of this accident having occurred to drunken men from falls. One feature of these cases is of medico-legal importance, *viz.*, that no symptoms of the injury may appear for several hours. Bartch records the case of a drunken man who fell from a window 12 feet on to hard ground, sat down for an hour then walked upstairs to bed, slept well and got up in the morning and walked a mile. He then got a rigor, became ill and died 63 hours after the fall. On post-mortem examination, 52ozs. of urine were found in the peritoneal cavity and a tear 2½″ long in upper and posterior part of the bladder.

Rupture is seldom due to over distention consequent of urethral stricture, as the walls are thickened ; in cases of stricture rupture is more likely to occur in the urethra behind the stricture.

Spontaneous rupture of the bladder has been recorded in drunken men, but it is difficult to exclude the possibility of the injury having been caused by a fall, or some other form of violence.

Rupture of the urethra is a serious injury, there is the danger of extravasation of urine, and subsequently of stricture. The rupture usually occurs where the urethra passes under the pubic arch, just in front or just behind the triangular ligament, which is generally torn. Complete rupture is more dangerous than partial, a slight tear may heal rapidly without extravasation of urine having occurred, provided the patient came under treatment very soon after the injury was received. The causes of rupture of the urethra are falls, blows or kicks on the perineum. The urethra may be ruptured in cases of fractured pelvis and other severe injuries.

Fracture of the pelvis is nearly always caused by great violence, the passage of the wheel of a heavily loaded cart, or a crush between the buffers of railway carriages, or heavy bales falling on the body. In one case, a man was crushed between two railway wagons, the pelvis was fractured, the bones broken into several pieces, the rectum and bladder extensively lacerated, large extravasations of blood in the tissues of the pelvis and in the abdominal walls ; he lived for over 24 hours.

INJURIES OF THE EXTERNAL GENITALS.—In males injuries of the external genitals are seldom fatal, though the parts being extremely sensitive and very vascular, dangerous shock and hæmorrhage may be produced. Self-mutilation has been frequently recorded among insane persons under the influence of delusions of a religious type, and also among persons suffering from delirium tremens. In one of the recorded cases, the penis and testicles were cut off with a rusty scissors, and one of the testicles was eaten. Some years ago, in a body discovered in a ditch, the penis and testicles had been completely removed, evidently some days before death. It appears there are in Calcutta a considerable number of eunuchs, who have voluntarily submitted themselves to the operation. In making a post-mortem examination on the body of an old man, I discovered that the penis and scrotum had been completely removed, evidently many years before, the condition of the anus gave a clue to the object of the operation.

Cutting off the external genitals is a not infrequently practised punishment for adultery, though as a rule, the adulterer is killed first, and mutilated after death.

Wounds and injuries of the external genitals of females are dangerous, sometimes fatal, from shock and hæmorrhage. The parts are very vascular and great difficulty may be experienced in stopping bleeding. There are on record many cases of accidental death from wounds of the female genitals, caused by sitting on broken crockery, falling on pointed objects, and many homicidal cases due to the thrust of a pointed stick or iron rod, and to kicks. Beck mentions two cases of murder by husbands, who made incisions on the inner surface of the labia minora and vaginal wall, and when the women were nearly dead, called for medical assistance, believing, no doubt, that the hæmorrhage would be taken for flooding from the uterus. Wounds of the vagina, in addition to the risk of death from hæmorrhage, may open the peritoneal cavity and set up fatal peritonitis. The vagina has been injured in attempts to procure abortion, also by the introduction of stones, pieces of stick, and other objects by women themselves, for no apparent reason. Laceration of the vagina, sometimes fatal, has been caused by coitus in children and in adults. Self-mutilation by females is very rare. Rupture of the gravid uterus may be caused by falls, blows, kicks, and other forms of violence. The uterus may rupture during parturition, also from the use of instruments to assist delivery. Wounding of the vagina may occur during obstetric operations ; a woman was admitted to the Eden Hospital in a collapsed state, there was a history of prolonged labour and that a medical man had performed decapitation of the child but failed to remove the head. On examination, a huge wound was found in the posterior wall of the vagina into the abdomen, portion of small intestine lay in the vagina. The woman died within a few minutes.

Injuries of the gravid uterus without causing rupture, may produce serious consequences ; separation, partial or complete, of the placenta, resulting in dangerous or fatal hæmorrhage, may follow a blow. Inflammation of the seat of injury in the wall of the uterus may also result from a blow, and end in softening and rupture, or the inflammatory process may cause adhesion between the uterus and placenta, necessitating an operation at the time of parturition.

INJURIES OF THE EXTREMITIES.—For the medical jurist the most important injuries of the limbs are fractures and dislocations, not that they are often fatal, except in complicated cases, but because they not infrequently give rise to actions for damages, and questions of great difficulty regarding causation, effects, and treatment may have to be answered.

The force required to fracture a bone varies with its size, shape and texture ; in some persons, the bones exhibit an abnormal frangibility. Some of these cases are suffering from general diseases in which trophic changes in the bones occur as one of the symptoms, but in others no sign of disease is present, the individual appears healthy. Recently in the Howrah General Hospital, a Bengali youth was treated for fracture of the femur. He stated that when running during a game of football, he felt the bone snap, and immediately fell down. There was no one close to him at the time, and he was positive that the bone broke before he fell. The fracture was in the upper third of the shaft of the femur and united firmly in the usual time.

In old age the bones become brittle from changes in texture especially from excess of inorganic material, and fractures occur from very slight violence. In children the bones are tough and elastic, and may be forcibly bent without breaking, or the fracture may take the form known as greenstick.

Trophic changes producing abnormal frangibility, often occur in insane persons, and in asylums, fractures of ribs and of other bones may result from slight violence or from muscular action. Cases of this kind not infrequently lead to charges of assault against the attendants ; if the individual dies, a careful examination of the bones may enable the medical jurist to give an opinion regarding the force used and the manner in which the injuries were produced, but in most cases he cannot make a positive statement. In these cases, also in other cases, it may be of great importance to determine the time the fractures have existed ; a careful examination of the state of the surrounding tissues and of the broken ends of the bone will enable an approximate date to be fixed. When a bone is fractured, hæmorrhage takes place from the ends of the bone and from the surrounding tissues which have been lacerated. For about a week, no change is apparent beyond alteration in the colour of the effused blood, but if sections are made and examined under the microscope, a proliferation of the cells of the periosteum and of the connective tissue of the bone can be seen within two or three days, and by the end of a week, the broken bone is found imbedded in a soft mass of newly-formed granulation tissue which is called callus. The quantity of callus varies, if the fragments were kept at rest, very little is produced, and only between the broken ends ; if the fragments have been moved, a large mass is formed which surrounds the broken bone like a ferule. From the tenth to the fifteenth day, the process of ossification commences, generally in the angle between the periosteum and the bone. The callus becomes fibrous before it is ossified, and forms a firm union between the broken parts, long before ossification is completed, which takes about two months.

The process of union, as described, is what occurs in a healthy individual, delay and alterations may be caused by constitutional conditions, and in arriving at a conclusion regarding the length of time a bone has been fractured, these must be considered.

CHAPTER XII.

FATAL INJURIES.

Every injury by which death is caused is a fatal injury, and it makes no difference whether the injury is of a kind usually fatal or only so in rare instances. In the older works on medical jurisprudence wounds were classified as slight, dangerous, and mortal ; such classification is useless and incorrect, persons have recovered from wounds which in most cases prove fatal, and death has been caused by injuries of a trivial character. If an individual dies from an injury of any kind, it is, in his case, a fatal injury.

In examining cases of fatal injury, it is necessary to determine, firstly, the immediate cause of death ; secondly, was the immediate cause of death the result of the injury, and if this be the case ; thirdly, was the fatal injury due to the act of another person or in what way was it produced.

It is not always easy, and it may be impossible, from the examination of the dead body, to determine what was the immediate cause of death. In certain cases, by no means very uncommon, no lesion of the body can be found to account for the death, and the opinion as to the immediate cause of death can only be inferential, based on the history of the case and the absence of lesions.

The immediate causes of death from injuries are :—(1) Destruction or serious injury of an important organ or part with consequent loss of its function.

(2) Mechanical disturbance of an organ or part by pressure, so that its functions cannot be performed.

(3) Hæmorrhage which may be internal or external.

The effect produced on the individual depends on the amount of blood lost, and, even more, on the rate of the loss ; fatal syncope results from the opening of a large artery before much blood has escaped, whereas from a small vessel an enormous quantity may drain away before death occurs. When a large artery is severed, blood pressure falls and fatal syncope takes place, but in bleeding from a small vessel, the vaso-constrictor mechanism has time to act, and by diminishing the capacity of the vessels throughout the body, keeps up the blood pressure, and the supply to the central nervous system, until the quantity of blood is enormously reduced.

Children bear the loss of blood badly but recover rapidly, old people stand the loss better but the effects are more lasting.

(4) Shock is a condition of sudden depression of the vital functions, due to powerful impressions on the central nervous system by injury, or mental emotion. Shock occurs in different degrees of severity, it may be only a temporary lowering of the vital functions, or of so profound a character that death occurs immediately or within a few minutes. The differences in the intensity of shock depend on the cause and on the individual ; in some persons, a trifling injury of any kind, produces marked shock, others exhibit an extraordinary insusceptibility.

Injury is the chief cause of shock, and as a general rule, the more extensive the lesions and the greater the disorganisation of the affected part, the more intense the shock. Medico-legally, it is of great importance to bear in mind that a blow on certain parts of the body may cause fatal shock without any local sign of injury, the abdomen, the chest, the larynx, appear specially susceptible.

As a rule, shock is manifested immediately, but if the individual is in a state of great excitement and mental pre-occupation, it may be deferred for a considerable time :—thus, a man exposed to great danger, may subsequently exhibit profound shock, and similarly, injuries received in conditions of excitement, may not be noticed until afterwards, and when the individual discovers their existence and his danger, he may fall into a fatal state of shock.

The post-mortem appearances of death from shock are negative, the opinion that death was due to this cause is necessarily inferential.

Shock and hæmorrhage are often combined in cases of injury.

Suffocation may be the immediate cause of death from wounds, as for instance, the entrance of blood into the air passage from wounds of the throat or pharynx, or pressure on the lungs by the accumulation of blood in the chest.

Entrance of air into veins is said to cause death by the admixture of the air and blood blocking the capillaries in the lungs, and so causing distention and paralysis of the right side of the heart. It is a very rare accident if it occurs at all, which is doubtful.

The occurrence of fat embolism from the entrance of globules of fat into the circulation through torn veins is another cause of death of very doubtful reality. Brouardel believes that the so-called fat emboli are septic foci and colonies of organisms, and air emboli, gases developed by putrefaction.

Secondary causes of death from injuries are inflammation, septic processes, exhaustion, and tetanus. The latter, in India, is of common occurrence, both in connection with wounds and idiopathically.

Any of the above-named diseases may occur in a case of even slight injury and cause death. If the injury was caused by another person the question of his responsibility is for the Magistrate or jury to decide ; the duty of the medical jurist consists in placing before the Court a clear description of the injury, and of the cause of death. In India, the law considers the intention of the person who does an act whereby the death of another is caused. Section 299 of Indian Penal Code lays down :—

" Whoever causes death by doing an act with the intention of causing death, or with the intention of causing such bodily injury as is likely to cause death, or with the knowledge that he is likely by such act to cause death, commits the offence of culpable homicide.

Explanation 1.—A person who causes bodily injury to another who is labouring under a disorder, disease or bodily infirmity, and thereby accelerates the death of that other, shall be deemed to have caused his death.

Explanation 2.—Where death is caused by bodily injury, the person who causes such bodily injury shall be deemed to have caused the death, although by resorting to proper remedies and skilful treatment the death might have been prevented.

Explanation 3.—The causing of the death of a child in the mother's womb is not homicide. But it may amount to culpable homicide to cause the death of a living child, if any part of that child has been brought forth, though the child may not have breathed or been completely born."

Section 300.—" Except in the cases hereinafter excepted, culpable homicide is murder, if the act by which the death is caused is done with the intention of causing death, or—

2ndly.—If it is done with the intention of causing such bodily injury as the offender knows to be likely to cause the death of the person to whom the harm is caused, or—

3rdly.—If it is done with the intention of causing bodily injury to any person and the bodily injury intended to be inflicted is sufficient in the ordinary course of nature to cause death, or—

4thly.—If the person committing the act knows that it is so imminently dangerous that it must in all probability cause death, or such bodily injury as is likely to cause death, and commits such act without any excuse for incurring the risk of causing death or such injury as aforesaid.

Illustrations.

(*a*) *A* shoots *Z* with the intention of killing him. *Z* dies in consequence. *A* commits murder.

(*b*) *A*, knowing that *Z* is labouring under such a disease that a blow is likely to cause his death, strikes him with the intention of causing bodily injury. *Z* dies in consequence of the blow. *A* is guilty of murder, although the blow might not have been sufficient in the ordinary course of nature to cause the death of a person in a sound state of health. But if *A*, not knowing that *Z* is labouring under any disease, gives him such a blow as would not in the ordinary course of nature, kill a person in a sound state of health, here *A*, although he may intend to cause bodily injury, is not guilty of murder, if he did not intend to cause death or such bodily injury as in the ordinary course of nature would cause death.

(*c*) *A* intentionally gives *Z* a sword-cut or club-wound sufficient to cause the death of a man in the ordinary course of nature.

Z dies in consequence. Here *A* is guilty of murder, although he may not have intended to cause *Z's* death.

(*d*) *A* without any excuse fires a loaded cannon into a crowd of persons and kills one of them. *A* is guilty of murder, although he may not have had a premeditated design to kill any particular individual."

Attempt to murder is provided for in Section 307. It is unnecessary to quote further from the Indian Penal Code; the above show clearly that the law looks to the intention of the offender.

The following case of death from pyæmia due to rupture of the urethra, may be briefly described:—A man was kicked and his urethra ruptured. Next day he was taken to hospital; on admission there was swelling of the scrotum and perineum. A catheter was passed and tied in, but the patient would not allow it to remain, he removed it several times. From the evidence, it appears that no difficulty was experienced in re-introducing the catheter. Some days after admission, an incision was made in the perineum, the urethra for about one inch at the site of rupture, and the surrounding tissues were found in a gangrenous condition, and subsequently separated, leaving a fairly healthy granulating surface. Later on, pyæmic symptoms appeared, and the man died twenty days after admission to hospital, twenty-one days from the date of injury.

The medical officer who treated the case made the post-mortem examination, the details of which need not be described; there could be no doubt deceased died of pyæmia following the injury to the urethra.

In reply to questions, the medical officer stated that death was due to pyæmia which was the result, firstly, of the rupture of the urethra, and secondly, of the patient's own act in interfering with the treatment. One of the most important parts of the treatment of injuries of the urethra is the constant retention of a catheter in the bladder. The object being to prevent urine from coming in contact with the rupture, and so causing blood poisoning. The deceased refused to keep the catheter in his bladder, and was constantly withdrawing it. Pyæmia is not a necessary consequence of rupture of urethra. When the deceased was first admitted, a fatal termination was not expected. A rupture of the urethra is usually caused by falling astride on some hard substance, it might be caused by a kick. The rupture in the deceased could have been caused by a kick with boot shown.

In cross-examination by the counsel for the defence, the medical officer stated, the deceased commenced pulling out the catheter from almost the first day. If he had not done so, witness was of opinion that he would have recovered probably within three weeks. In one case witness treated, the man returned to his usual work after one week in hospital. As regards the case under investigation, witness was not prepared to say the man would not have recovered in a week if the treatment had not been interfered with.

QUESTIONS BY THE COURT.—In your opinion is a kick with the boot produced, on the perineum, likely to cause death ? No, I have no doubt about this.

Is it likely to cause the sufferer to be unable to follow his ordinary pursuits for 20 days ? I should not have advised him to resume his work after such a kick for three weeks.

Is such a kick likely to cause rupture of the urethra ?

Yes, to a certain degree, the rupture would more readily occur, if the individual kicked were stooping forward and the parts on the stretch.

You have already stated that rupture of the urethra is not under ordinary circumstances likely to cause death. Is it likely to cause the sufferer to be unable to follow his ordinary pursuits for 20 days ?

It depends on circumstances.

The Magistrate decided to obtain additional medical evidence, and the author, who, at the time held the appointment of Professor of Medical Jurisprudence and Police Surgeon, received a subpœna. Before attending Court, the solicitors for the accused tried to obtain answers to certain questions. They were not answered for obvious reasons, but may be quoted here as indicating the character of the questions put to an expert witness in cases of the kind :—1. In your opinion would a person not skilled in surgery intending to kick the posterior of another know that he is likely to cause (a) rupture of the urethra ; (b) any injury beyond ordinary hurt ?

2. Would such a person as aforesaid having delivered a kick on the perineum know that he was likely to cause such rupture or injury as aforesaid ?

3. Would the circumstance that the man kicked was stooping affect your answers to questions 1 and 2 ?

4. Is it not a fact that the portion of the urethra about an inch and a half behind the portion, which was kicked in this case, becomes imbedded deep in the tissues of the pelvis ?

5. If so, then supposing the kick had struck the deceased an inch and a half behind the portion which was actually kicked, would it have caused any injury ? If not an inch and a half then how much ?

6. Would you be inclined to contradict the Surgeon who attended this particular case and saw the patient almost every day, in his opinions expressed with regard to the prospect of recovery and the time which such recovery would have taken in this particular case ?

7. The Surgeon has said that the patient progressed favourably, and that if he had not interfered with the treatment by pulling out the catheter, it was distinctly his opinion that the man would have recovered probably within three weeks.

8. He has further said, the man under favourable circumstances would have taken a fortnight or three weeks to get well ; and then might have been able to discharge his avocation as a coolie. Would you be inclined to contradict these statements. If so in what percentage of cases ?

The case was sent for trial before the Sessions Court, the accused was acquitted.

The post-mortem examination in all fatal cases of injury must be complete, so that the medical jurist may be able to answer questions regarding the state of every organ and tissue. When death follows a slight injury or one not usually fatal, the influence of pre-existing disease in bringing about the fatal result must be carefully weighed and placed before the Court. Although the person who caused the injury is responsible for the consequences of his act, the presence in the injured person of a diseased condition, owing to which the injury caused death, is always taken into consideration by the Court. In cases of this description, the medical jurist is generally asked, was the disease of a kind the existence of which would likely be known to the accused. The answer depends on the nature of the disease and the circumstances. It is very improbable that a stranger would know anything of the state of health of a man with whom he happened to quarrel, unless the latter was suffering from some very marked and visible affection, but it is likely that all the members of a family would be aware of the existence of disease of the spleen or other chronic malady in one of the household.

The influence of constitutional conditions on injuries is well known ; in chronic drunkards, wounds heal with difficulty and are often attacked by septic processes, the arteries are generally unhealthy, especially those in the brain, and rupture may follow a slight blow, on from mental excitement. Disease of the arteries is common in old age, and fatal cerebral hæmorrhage may occur during a quarrel from the increased blood pressure brought about by the excitement. In cases of heart disease, especially of the aortic orifice, sudden death may occur during a quarrel from paralysis of the heart, caused by the raising of blood pressure produced by mental excitement. In 1894, two men were quarrelling in a lane, blows or slaps were received by both, the persons looking on, raised the cry of police are coming. The men ran in different directions, one had not gone more than a few feet before he stopped, and as the description put it, fell in a heap and died immediately. On post-mortem examination, the only sign of of external injury was a small bruise and abrasion on the outer side of the left knee. The heart was greatly enlarged, a typical *cor bovinum*, the aortic valves were extremely diseased, the left ventricle greatly dilated and hypertrophied, the other chambers were also enlarged.

The man with whom the deceased had quarrelled, was placed before the Magistrate, who, on hearing my evidence, dismissed the case.

In 1900, an exactly similar case occurred, two men quarrelled in a tramcar, there was much abusive language, and it was alleged, the deceased was struck with an umbrella, and soon after fell forwards dead. The heart was very large, aortic disease of long standing. The accused was a Eurasian, and racial feeling was introduced into the case. The lower class of native newspapers continued to pour abuse on the Police Surgeon for weeks; the unfortunate accused was harassed, put to, for him, enormous expense and fined fifty rupees. In both these cases, I gave the opinion that death was due to heart-disease, and that the mental excitement produced by the quarrel led to the fatal result by raising the blood pressure, and that the blows, of which there were no signs, did not cause the heart to stop.

When an injury proves fatal some time after it was inflicted and deceased has been under treatment, the defence may attempt to show that the treatment was improper and caused the death, or that a fatal result would not have occurred, if the injury had been properly treated. The law states clearly that, where death is caused by an injury, the accused is responsible, although death might have been prevented by proper treatment, yet, as a matter of fact, conviction for murder is not likely to take place if the medical evidence shows that the injury was not originally fatal and only became so by unskilful treatment or wilful neglect on the part of the injured person. In India, medical assistance is not always available, and a man, through no fault of his, may die of an injury from which, if properly treated, he would have recovered; here, undoubtedly, the responsibility of the accused is in no way lessened. The circumstances are altogether different when a wounded person refuses medical treatment or prevents it being properly carried out, as in the case of rupture of the urethra, before mentioned.

CHAPTER XIII.

WOUNDS AND INJURIES IN REGARD TO THEIR CAUSATION BY ACCIDENT, SUICIDE, OR HOMICIDE.

When death is due to wounds or other injuries, the medical jurist is required to give an opinion regarding their causation —Were they the result of accident, or self inflicted, or caused by another person? The question is of the greatest importance, and to answer it consideration must be given to all the circumstances of the case, the appearances of the body generally, the situation, extent, direction and character of the wounds.

In death by wounding, an inspection of the body at the place it was discovered, before it and the surroundings have been disturbed, is always of assistance, and in difficult cases of the greatest importance, in arriving at a conclusion as to the nature of the case. Everything on and about the body should be noted, as a learned judge truly remarked, "a man when he sees a dead body should notice everything." Appearances, minute and apparently of no importance, may subsequently prove of the greatest value in determining the nature of the case or in fixing the guilt of the murderer. The inspection should be carried out systematically, every point as observed written down. The course to be adopted must be left to the discretion of the medical jurist; I have found it convenient to first note the position and posture of the body, the condition as to temperature and rigor mortis; if a weapon is present, its position in relation to the body, if in the hand, whether grasped or lying loose; the direction of the blood flow from the wound; the state of the clothing; condition of the feet of the deceased; bloody foot-prints and blood marks on the floor, signs indicating the presence of persons other than the deceased, marks of a struggle; bloody finger prints on the walls and furniture.

Individuals dying from wounds differ greatly; some lie quiet, others are restless, and unless completely disabled, move about. In a case of suicide by cut-throat, there were masses of blood and bloody foot-prints all over the room, in the verandah, and on the adjoining terrace roof. The knife was found hidden beneath a pile of clothes in the corner of the room. The deceased was lying across his bed, face downwards. The front of the body and clothes were covered with blood, the hands were smeared all over with blood. There were marks of bloody hands on the walls, near the door, and on the verandah ; two chairs were over-turned, the top bar of one was marked by bloody fingers.

The front of the neck was cut across, the wound was short, between the sterno-mastoids, and involved the external jugular vein, which was not completely divided, and the superficial vessels on one side of the neck. The larynx was opened, there was much blood in the trachea and bronchi, death was probably due as much to asphyxia as to hæmorrhage.

In cases of homicide by wounding, the question is often asked in Court :—Could the deceased have walked, spoken, or performed other actions, after he received the fatal injuries ? The question is one of great difficulty. Cases are recorded of individuals having performed actions requiring considerable strength after they had received wounds, which in most persons would have caused immediate disablement and death within a few minutes. In dealing with wounds of the heart, two cases are mentioned. In one, a man after receiving a wound, which passed through the left ventricle, spoke, and walked a short distance. The other is the case of the man Woods shot through the right auricle. I have had recently under treatment a case of severe injury to the skull and brain. A man was brought to Hospital from a place about eight miles from Howrah. The history was that he had been struck on the top of the head with heavy bamboo. After receiving the injury, with the help of his son, he got out of his boat and walked to the police station, a short distance. On admission to hospital, he was quite conscious, but could not speak, there was partial paralysis of the right arm and leg. On the top of the head, to the left of the middle line, there was a small laceration of the scalp, and an extensive depressed fracture. Portions of bone about two inches square were removed ; the dura mater was found to be lacerated, brain substance exuding. He lived sixty hours after receiving the injury. He was conscious the whole of the time.

On the second day, during the absence of his son, he got out of bed to urinate. Death occurred suddenly and unexpectedly. On post-mortem examination, the corpus callosum was found completely disorganized by effused blood. There was a large mass of blood in the centre of the brain, the left corpus striatum and optic thalamus were infiltrated with blood. The lesions were so extensive that without the history of the case immediate death would have been confidently inferred.

These cases show the necessity for great caution in answering questions regarding the disabling effects of injuries. In the cases quoted, the individuals exhibited an extraordinary resisting power, and it is highly probable that most people, under similar circumstances, would have been immediately and completely disabled, or killed outright. The medical jurist must take exceptional cases into consideration when answering questions in a law court.

In the morgue or place where the post-mortem examination is held, the clothing should be carefully examined, its general condition, wet, soiled with mud or dust, torn, cut, stained with blood, semen or other matter. Each garment should be removed and examined. When cuts are found in the clothing their position and relation to wounds must be noted. In gunshot cases marks of burning and powder stains are to be looked for. The effect of the clothing in modifying the results of blows should be considered. The presence of a thick puggri may completely alter the effect of a blow on the head.

The post-mortem examination, as in every medico-legal case, must be complete, every organ should be examined, and the viscera retained for analysis. It is advisable to inspect the whole of the body and write down a description of all external lesions before opening the cavities. The position, extent, direction and character of the lesions should be carefully recorded ; the medical jurist should consider the question of the kind of weapon which could have caused them. If a weapon is forthcoming he should judge whether it was capable of producing them. He must be careful not to touch the weapon when his hands are soiled with blood. The size of injuries should be ascertained with a measure, and should be at once written down. Blood effusions in the cavities of the body must also be measured accurately. Guessing the size of wounds or the quantity of blood effused should be avoided.

In examining wounds, care is necessary to avoid enlarging them, the dissection must be carried out cautiously.

In death by wounding, the situation, direction, extent and character of the wounds, assist in determining whether they were caused by accident, suicide, or homicide.

Suicidal wounds are usually on parts of the body which are easily reached and which are known to contain vital structures, the throat for incised wounds, the chest for stabs, the mouth, head and chest for gun-shot wounds. But murderers generally select the same situations. Wounds on the back are usually homicidal. I have met with one case of attempted suicide by wounding the back of the neck. It is probable that the woman selected this part because of the shape of the weapon, a boiti, a large curved blade fixed at an angle to a piece of flat wood. The woman made a large, deep wound on the back of the neck, the spinal canal was opened, the cord escaped.

Suicide by opening the vessels at the wrist or elbow is very rare in India. Self-inflicted wounds of the abdomen are also rare, but I have met with two cases, both in men. In one, there was a large wound in the middle line from the navel to the sternum, the intestines and stomach were not injured, but the diaphragm was penetrated and the right ventricle of the heart opened. The other case was of an unusual character. The deceased, a servant in the Medical College Hospital, was found lying on the floor of a latrine, off one of the wards, at 4-30 A. M. He was bleeding from a wound on the neck, and a large mass of intestines protruded from a wound in the abdomen. A portion of intestine, completely severed, was lying on the floor which was smeared with blood and fæces. The man died at 11 A. M. The post-mortem was held half an hour after death. The wound on the neck was transverse, low down, and divided only the anterior jugular veins. The abdominal wound was in the middle line, and extended from an inch below the sternum to the navel, at the lower end it turned abruptly to the right for about an inch. A large mass of intestines and portion of the stomach were protruding. The colon was cut across near the hepatic flexure. The portion of intestine which was found near the body, was forty inches long, and consisted of large intestine, about eight inches were formed of the complete gut, the remainder of the mucous tube only. Apparently having opened his abdomen, he seized and divided the colon, and pulling on it drew out a long tube of the mucous coat. From inquiry, it appeared that he had been strange in his manner for some days.

In Japan suicide by wounding the abdomen is of frequent occurrence.

Suicide by contused wounds is a method only likely to be adopted by lunatics. There are several remarkable cases on record. An insane battered in the top of his head by repeated blows with a heavy hammer. Another, with a mallet, drove two chisels into his head, one through from temple to temple, the other into the forehead, penetrating the frontal lobe for about half an inch.

Suicide by cut-throat is not very common in Calcutta. During a period of $7\frac{9}{12}$ years, I examined 17 cases, of these 16 were men, 1 woman. The position of the wound in these cases bears out the general opinion that suicidal wounds of the throat are high up, in 8 the wound was above the thyroid cartilage, in 5 the cartilage was cut, and in 4 the wound was low down.

As a rule, the suicide stands, the head is thrown back, the weapon, held in the right hand, is applied high up on the left side, over the sterno-mastoid, and drawn across the throat obliquely from left to right, the beginning of the cut being higher than the termination. Of course, in a left-handed person the wound begins on the right and slopes to the left. When a wound of the neck is oblique, the beginning is almost always higher than the termination, but it sometimes happens that during the cutting, the neck is moved or the direction of the hand altered with the result that the end is higher than the beginning. The appearance of the skin and surface of the wound will indicate the change in direction.

The extent of a suicidal wound depends on the weapon, and especially on the determination of the individual. A suicide may cut down to and wound the front of the spine. The following case may be quoted, it occurred in 1895. The deceased, a watchmaker, had been very depressed owing to the state of his eyes. On the morning of the 9th of April, he was seen by his sister, sitting on his bed, cutting his throat with a razor. She caught hold of the razor, receiving some cuts on her fingers, her aunt came and they managed to take it away, the deceased died almost immediately. I held the post-mortem examination on the same day. Both pupils were irregular from chronic iritis. On the radial side of the back of the left wrist there were three small parallel incisions, quite superficial, apparently caused in testing the keenness of the razor. The throat was cut across high up, the wound was five inches long and sloped slightly from left to right. It began in front of the left sterno-mastoid muscle. The pharynx was opened in the thyro-hyoid space, the epiglottis was wounded. The tissues were divided down to the spine which was visible. The appearance of the surface of the wound showed that it had been made by repeated use of the razor. The right common carotid and internal jugular vein were cut across, and on the front of the spine, there were seven superficial incisions on the anterior spinal ligament, none of them penetrated to the vertebræ. Both pneumogastric nerves and the vessels of the left side had escaped.

As a rule, a suicidal wound is more on one side of the neck, and generally on the side where it commenced, but it may be of equal extent on both sides, or more extensive on the terminal side. Wounds low down on the neck are often short, extending from sterno-mastoid to sterno-mastoid, and in these cases the carotids and internal jugular veins generally escape. Bleeding occurs from the anterior jugular veins, and small arteries ; if the windpipe is opened, death may be caused by suffocation, but the hæmorrhage from the divided vessels may be sufficient to cause death.

In many cases of suicidal cut-throat, superficial incisions are found near the main wound, in the same direction, above or below it, or beyond the commencement. The suicide apparently makes hesitating cuts before inflicting the fatal wound. The surface of a suicidal wound commonly shows signs of more than one application of the weapon. The first incision causes a gaping wound, in which the knife is again applied. The skin edge is often notched. More than one severe wound on the neck does not exclude suicide. In an undoubted case of suicide, the throat was cut across from left to right, high up, the carotid vessels were not divided, bleeding took place from branches of the lingual and facial arteries. At the right extremity of the wound, there was a stab penetrating, behind the larynx, to the left side of the spine.

In another suicide, there were two large wounds on the neck, one extended from a point two and a half inches below and one inch in front of the left ear forwards across the throat, terminating an inch to the right of the middle line. It was directed slightly upwards. The first portion was skin deep, the middle involved the muscles, the external jugular vein was opened, not divided. The windpipe was opened in the crico-thyroid space, the wound again became skin deep only. On the right side of the neck, there was a deep wound, beginning at a point two inches below and three inches behind the ear; it passed obliquely downwards and forwards, terminating an inch to the right of the middle line, the last portion was superficial. The muscles of the side of the neck were divided down to the spine. The transverse process of the 4th cervical vertebra was notched. In this wound, as in the other, the principal vessel involved was the external jugular vein, which was opened. The deceased, a waterman, was seen at work in his master's house, at 7 A. M., and was found dead in a bath room at 9 A. M. I inspected the place before anything had been disturbed. The body lay face downwards on the floor in a large pool of blood, a knife was found beneath the body. There were splashes and arterial spirts on the back of the door, the highest was 49 inches from the floor. Both the hands and arms were bloody, on the right arm there were arterial spirts.

In suicide by cut-throat, the hand that uses the knife is always blood-stained. It cannot escape, if any ordinary weapon was used. The arm is also stained by streams of blood which flow from the hand along the front of the fore arm; very often arterial spirts are seen directed on the forearm and on the arm towards the elbow, indicating the bent state of the limb at the moment they fell on it. The distribution and character of the blood-stains should be examined, attention directed towards determining whether they were caused by streams and arterial spirts, or resulted from the contact of the parts with a bloody garment or a pool of blood. When death is due to cut-throat, the absence of blood from the hands is a very suspicious circumstance, however marked the suicidal characters of the wound may be. It is necessary to recollect that a murderer can produce a wound on the neck exactly like one caused by suicide, though as a rule he has not the necessary skill and calmness. In murder cases, if the victim was taken by surprise or if he was asleep, death might occur without a struggle, and no blood be found on the hands or only smears caused by contact with a bloody garment or a mass of blood. In cases where a struggle occurred, the hands are bloody, and often cut in attempting to protect the neck. The victim after receiving the fatal wound, may put his hands to his neck and insert them into the wound ; should this occur the hands and arms will be covered with blood.

In most suicidal wounds of the neck, the beginning and termination are tailed, that is the cut is longer in the skin than in the underlying tissues. Tailing is due to the way the cutting instrument is used. If plunged in and drawn through the tissues at a right angle, the beginning will show a small notch owing to the retraction of the skin, the termination will be under cut, as the skin yields in front of the blade and resumes its position when the latter is withdrawn. If the knife was held obliquely to the surface during the cutting, the beginning is tailed and the end also. Experience shows that suicidal wounds are generally tailed, and that the termination of a homicidal wound is often undercut. But it is not uncommon in murder cases to find tailing of both extremities, and the end of a suicidal wound may be undercut. In a case of attempted suicide recently under treatment, the beginning of the wound was tailed, the termination undercut.

In murder by cut-throat, the direction of the wound depends on the position of the assailant and the way the weapon is used. If in front and right-handed, the wound will be directed from right to left sloping slightly. When the murderer is behind, or on the right of the victim, he generally makes a wound from left to right, similar in direction to one of suicidal origin. Homicidal wounds are generally in the lower part of the neck, but they may be high up. Thus, in a woman found dead on her bed, the throat was cut from ear to ear ; the wound involved the lobes of both ears, the parotid glands were cut, the left external carotid artery was divided, both internal jugular veins were opened, the right common carotid artery was cut across. The thyroid cartilage was divided, from left to right, above the false vocal cords. The tissues were divided down to the spine ; there were four cuts on the body of the axis, three were directed from left to right, the fourth from right to left. There were several cuts on both hands and arms, and one on the chin. A blood stained table knife was found beneath a bed in the room.

In another case, the deceased, a prostitute, was found dead in her room, with her throat cut. The wound was transverse, the left extremity was tailed, the right was hacked. The wound gaped and exposed the spine. The larynx was divided above the vocal cords. There were seven cuts on the spine, one divided three-fourths of the disc between the third and fourth cervical vertebræ, another between the fourth and fifth was nearly as deep, the others were into the bodies of the vertebræ. The left sterno-mastoid muscle was notched, the right cut across. The common carotid and internal jugular vein of the right side were divided, those of the left escaped.

Apparently the deceased was surprised and killed without a struggle. There was no other wound on the body ; the right hand was clean, the left slightly soiled with blood. There were a few dried streams of blood on the front of the chest and arms, but nearly the whole of the blood from the wound flowed backwards on to the bed and floor.

If this case be compared with that of the watchmaker previously described, a great similarity in the general appearance of the wounds in the two cases will be noticed, and also important differences which distinguish a wound of homicidal origin from one of self infliction. The watchmaker divided the right common carotid and internal jugular vein, exposed the spine and inflicted seven cuts on it. The murderer of the woman made a similar wound, cut across the same vessels, and made seven cuts on the spine, but with the important difference, that whereas the cuts made by the watchmaker were superficial involving only the anterior spinal ligament; those in the woman were deep, all were into the spine, two divided intervertebral discs to about three-fourths of their depth. Both the hands of the watchmaker were covered with blood, the woman's right hand had no blood on it, her left was slightly soiled probably from contact with the bed.

Experience supports Taylor's opinion:—"Suicides may graze the ligaments in front of the spinal column, but that they should make deep incisions into the bone is a proposition contrary to all experience and probability."

Homicidal wounds on the neck or other parts are usually characterised by great severity and redundancy. The murderer uses excessive violence, more than is necessary to kill. This feature was marked in all the cases of murder by cut throat which I have examined except one, in that the murderer was disturbed, and his victim was able to rush out of the hut and died while being taken to Hospital. It appears, the deceased, a prostitute, was in the habit of visiting a shop-keeper, who lived in a room in a mud hut. About mid-night, the occupant of the adjoining room heard a noise and a sound of groaning, he called to ask what was the matter. The shop-keeper made some reply. Just then a woman rushed out and sank down on the foot path. The neighbour went to her and finding her wounded, called the beat constable, who fastened the door of the room, the shop keeper was still inside, and had the woman taken to Hospital. She died on the way. At the post-mortem examination, I found several severe wounds on the palmar surface of both hands, a small incision on the right shoulder, another below the right clavicle. The hands, arms and front of the body were covered with blood. On the neck, there were two wounds, the upper one was on the front and left side and sloped from right to left. In the centre it was over the hyoid bone, which was scored, the remainder was through the skin and superficial tissues. The second wound, on the lower part of the neck, also sloped from right to left. The beginning was tailed, in the centre the thyroid cartilage and œsophagus were divided, the left internal jugular vein was exposed, but not injured, the carotids were not visible. The tissues on the front of the spine were not injured. There was much blood in the trachea and bronchi.

In court, the medical jurist may be asked:—Could the deceased have cried out or spoken after the throat was cut? The answer depends on the extent and position of the wounds. If the throat was divided so that all air passed out through the wound, voice is lost, but by bending the head and thus closing the wound crying out and articulation are possible. If the wound divided the recurrent laryngeal nerves, voice is destroyed.

In arriving at a conclusion regarding the nature of a case of cut-throat, the condition of the deceased must be considered. Experience has shown that females, especially in India, seldom resort to wounding as the means of committing suicide, They nearly always destroy themselves in other ways, poison, hanging, drowning. In the only case of suicide by cut-throat in a woman, which I examined, the deceased was an up-country woman, employed as a servant, the wound on her throat was two and a half inches long, situated low down, transverse in direction, both ends tailed. The windpipe was opened in the crico-thyroid space, the anterior jugular veins were divided, the large vessels were not exposed. The distribution of the blood showed that the wound was inflicted in the standing or sitting posture, a large table knife was found partly beneath the right thigh. The wound was not of a kind to cause death rapidly, nor to immediately disable; the windpipe was only opened, not severed, so that she could have called out.

The weapon used should be considered both as regards the wound and also in respect to the deceased. Women are not likely to choose a razor to kill themselves or others. It is an awkward kind of weapon, and one, which a person not in the habit of using, would find difficulty in holding with the firm grasp necessary to make a deep and extensive wound. But men, more in the habit of using knives and razors, and also generally possessed of a stronger grip and more determination than women, have produced on themselves and on others wounds of the severest character with a razor.

The regularity of a cut-throat wound has been considered by some medical jurists to point to suicide; by others to homicide. My experience is that most wounds of the neck are not regular. Suicidal wounds commonly exhibit notching of the skin, irregularity of the surface, indicating that they were caused by more than one application of the knife. This is the case especially in deep wounds reaching to the spine. In homicidal cases also, the wound is often irregular, it can hardly fail being so if there was a struggle, but if the victim was surprised, the murderer may divide the tissues down to the spine with one sweep, to do this he must be armed with a strong, sharp weapon, which must be applied with great force.

If the weapon is found grasped by the hand of the deceased, the fact points strongly to suicide. Care must be taken to distinguish real grasping from mere retention by the semiflexed position of the fingers, assisted by the stickiness of blood. Murderers have placed the weapon in the hand of the murdered person after death. The direction of the cutting edge should be noted, a murderer has put the knife in the hand of his victim with the edge turned in the wrong direction.

Stab wounds on the neck are not common ; in a case examined in 1893, there were eight deep stabs on the front and sides of the neck, the left common carotid and internal jugular vein were opened in two places. The larynx was penetrated above and below the vocal cords. The trachea was also punctured. The circumstances of the case pointed to murder ; on the nature of the wounds alone, suicide was not altogether excluded. In several cases of homicide, stabs were found on the neck and chest, and also incised wounds.

Stabs of the chest of suicidal origin are generally on the left side over the heart, and are usually directed downwards and inwards. Multiple stabs, if suicidal, are generally close together and in the same direction. The following case shows that several stabs on the neck and front of the chest, more than one of which was sufficient to cause death rapidly, may be suicidal. The case also shows that such wounds can be caused by a woman on herself. Early in the morning of the 13th July 1899, I was requested by the Police to inspect two bodies in a room in Phear's Lane. Nothing had been disturbed when I reached the place. In a small room, approached by an outside stair, were the dead bodies of a man and a woman. The man lay on his back, across the room, his feet on the sill of the door, his head and shoulders beneath the bed. The clothing consisted of a short flannel shirt and pyjamas, the feet were naked. There was some blood on the front of the shirt and pyjamas, and a broad streak extended from a wound on the right side of the neck down the front of the body to the pubes, and two streaks a short distance on the front of the left thigh. On the upper surface of both feet there were a few spots of blood, the soles were unstained. The arms were extended along the body, there was no blood on them nor on the hands except on the right index finger, which showed a faint mark, like blood. Behind the head and neck there was a considerable quantity of blood. On turning the body, the back of the pyjamas was found displaced downwards as would be caused by pulling the body along the floor.

It will be convenient to describe here, the wound found on the man. He was a powerful West Indian Negro, about 24 years of age. On the right side of the neck, in front, about an inch above the inner end of the clavicle, there was a stab which passed backwards, inclining downwards and inwards. The opening was 1⅜ inches. On dissection, the innominate artery was found divided through about three-fourths of its circumference, the right lung was wounded, the right pleura was full of blood, 50 ounces were measured, much had escaped in moving the body at the house and in the morgue. There was no other injury.

The woman, a Eurasian, lay on her back, on the left side of a double bed, which was placed close along the inner wall of the room. Her head rested on a pillow, the left arm and leg lay along the edge of the bed. The right arm was extended at an acute angle from the body, across the bed, the palm was upturned. Her only garment, a low necked night dress, was spotted with blood over the whole of the front, there was much blood behind the neck and upper part of the body. The face, chin and forehead were covered with blood, especially the left side. The arms were bare, the night dress was without sleeves. The right arm was marked with streaks and spots of blood. On the forearm, the spots were directed upwards, on the arm, downwards. There was a little blood on the left hand and arm. On the bed, to the right of the body, there were spots of blood and impressions of a bloody hand, one of these opposite the knee, was very complete, and was evidently produced by the woman's right hand and after the palm of the hand had been cut. On the inner side of the palm, extending obliquely forwards from the hypothenar eminence, there was an incised wound, an inch and a half long, through the skin, exposing the fat. The impression of the hand opposite the knee showed the mark of this wound. From the position of the impression, in relation to the knee, it is evident that it was produced when the woman was sitting up.

An open blood stained knife was found on the floor at the foot of the bed.

There were blood stains on various articles of furniture, and on the verandah, out side the door. The soles of the feet of both the deceased were free from blood. Both bodies were cold, and rigor mortis was beginning when first seen in the room.

The wounds on the woman were—the wound on the palm of the hand previously described. On the neck, (*a*) right side, an inch above the sternum, a stab, orifice three-fourths of an inch, direction nearly vertically downwards. The right common carotid was almost severed. (*b*) Also on right side, a stab situated immediately above the sternal end of the clavicle, the right subclavian artery was cut across, the right lung was wounded, the right pleura was filled with blood. (*c*) On the left side of the neck, just above the sternal end of the clavicle, a stab which penetrated deeply without involving the large vessels. (*d*) On the left side of the chest, a stab which penetrated between the ribs, passed through the anterior margin of the left lung, and pericardium, and opened the aorta, the wound in that vessel was half an inch long. There was some blood in the left side of the chest. (*e*) and (*f*) Two stabs, one on the sternum, the other on the left clavicle.

It is probable that in making one of these stabs, the knife, arrested suddenly by the bone, slipped through her grasp, and wounded the palm of the hand.

By the early post of the same morning, letters in the hand writing of the deceased woman, were received by the Commissioner of Police, the father of the dead man, and the woman's husband. The first may be quoted, it is dated the 12th July 1899 :—

"Dear Sir—I hereby declare that I have taken his life and mine also, because his father did not let me be happy while I was living with his son. He propose marrying to him, and he told me that it would be better, if we both separate ourself. I told his son that his father wants us to part, he got disheartend at that and propose to kill ourself, and said that if his father left us alone it would make us happy. He expressed himself in such a way that I could not bear to hear him and said that I will kill him and myself. I hope you will not take me for a mad woman when you receive my confessions and I hope you will not dissect us, because I swear on my life that I done it myself but punish that old fool L——.

I remain a sane woman,
Mrs. A. R.— "

The letter to the father of the man is in terms of wild abuse, threats of vengeance, haunting, and such like. To her husband she wrote asking his forgiveness, and that she might be buried decently.

During $7\frac{9}{12}$ years, I examined 39 cases of homicide by wounds, excluding gun-shot wounds. In 15 bodies, there were multiple wounds, more than one sufficient to cause death. In 11, death was due to one or more stabs of the chest involving the heart, great vessels, or lungs ; in two of these cases, the orifice of the stab was in the neck. In one case, there was a huge gash in the left side of the chest, dividing several ribs and cutting deeply into the lung, the man lived more than 24 hours. In one case, in addition to multiple wounds of the face and neck, many ribs were broken. Eight were cases of cut-throat, in one of these death occurred after several days from septicæmia. In one case, there were multiple stabs, at least eight, on the neck and throat. In 2 cases death was caused by peritonitis, due to a stab involving the intestines.

The investigation of gun-shot wounds with reference to their causation by accident, suicide, or homicide may be attended with great difficulty.

The characters of these wounds have been previously described, and the fact noted that the appearances, which are usually found in gun-shot wounds produced by the discharge of a weapon close to the body, are sometimes absent. It follows that suicide is not excluded by the absence of these signs.

In coming to a conclusion regarding the nature of a case of gun-shot wound, consideration must be given to the circumstances, the individual, the situation, direction, and appearances of the wound.

Women rarely use fire arms for suicide or for homicide.

The condition of the hands of the deceased should be noted, the hand used to fire the weapon may be blackened by powder, the fact points to suicide. A bullet wound within the mouth, with signs that the muzzle of the weapon was placed inside or opposite the open mouth, is very strong evidence of suicide. Multiple gun-shot wounds, even though more than one is of a kind to cause death rapidly, are not conclusive evidence of homicide. A suicide has been known to shoot himself in the heart and temple. There are also instances of individuals firing a bullet into the right temple and another into the heart.

A gun-shot wound in the back points to homicide. The position of the wound, its direction, and appearances, the condition of the clothing, may enable the medical jurist to form an opinion.

The most difficult cases are those in which, during a struggle, a person receives a fatal gun-shot wound. The defence will probably be that the weapon was accidentally discharged during the struggle, or during an attempt on the part of the accused, or of the deceased, to get possession of it. In December 1896, two men quarrelled in a room ; according to the dying statement of the wounded man, after the quarrel, during which blows were struck, the accused left the room, but returned immediately after, and from the door fired three or four shots from a revolver. Three of the shots struck the deceased, who was removed to hospital where he died some hours after. I held the post-mortem examination, about six hours after death. The deceased was a stout, well nourished Eurasian, aged about 40 years. The only clothing was a pair of white cotton trousers ; there was a tear and a patch of blood in the left side of the seat,corresponding to the position of an abrasion and bruise on the left buttock. The abrasion was one inch long and half an inch wide, beneath it there was a small effusion of blood.

The wounds on the body had been dressed in Hospital. On the left side of the chest there was a bullet wound, oval, edges ragged and inverted. The course of the bullet was across the body, passing between the eighth and ninth ribs, at a point one inch external to the nipple line, the diaphragm was perforated, also the stomach in two places, and the colon. On the abdominal wall on the right side, there was a small discoloured swelling from which, on section, fœtid fluid and much gas escaped. The bullet was found in the swelling, perfect in shape, not in the slightest distorted.

A little in front of the swelling in which the bullet was discovered, there was an entrance wound with inverted edges, and the track of a bullet in the abdominal wall, the exit being in front. This wound was four inches long, and did not open the abdomen.

The assailant, who had absconded, was captured and brought to Calcutta. At his request I examined him. There were several marks of abrasion on the knuckles of both hands and a small swelling on the scalp above the left ear. He stated these injuries and others which had disappeared were caused during the fight with the deceased. I omitted to mention that there were some scratches and small bruises on the right side of the neck of the deceased.

The accused was sent for trial at the High Court Sessions, and was ably defended by a member of the Calcutta bar. The defence was that the bullet wounds were caused by the accidental discharge of the revolver during an attempt made by the deceased to wrench it from the accused. Against this proposition there were the position and number of the wounds, their direction, the absence in all of them of any signs of the weapon having been discharged close to the body. The fatal wound had a direction almost transverse from left to right, inclining slightly downwards and forwards. The bullet was not altered in shape, and had met no structure which could have caused it to deflect, the track was straight. The other wound on the abdomen was on the right side and directed forwards and downwards. The graze on the left buttock had a direction obliquely forward.

The accused was found guilty of culpable homicide not amounting to murder.

If the weapon is found, its position in relation to the body should be noted. If grasped, the fact points to suicide, the necessity for distinguishing between real grasping and mere retention owing to the position of the fingers and hand is as great as in the case of cutting or other kind of weapons. The absence of a weapon near the body does not exclude suicide, it may have been thrown away by the deceased after he shot himself, or it may have been jerked by the force of the recoil and fallen into water or a drain or some place where it may not be discovered. In a case of undoubted suicide, the deceased, seated in an upstair room, shot himself with an old fashioned muzzle-loading pistol of large bore. Apparently he used a very large charge of powder, the top of the head from the level of the eyebrows was blown off. The pistol was found in the street, about thirty yards away.

The weapon found near the body should be examined for signs of recent discharge; it is advisable to send it to the chemical examiner for detailed examination. Bullets found in the body should be compared with the weapon. Murder has been committed, and a pistol belonging to deceased left near the body.

SELF-INFLICTED WOUNDS FEIGNING HOMICIDAL VIOLENCE.

Wounds of this class are not very uncommon, an individual may wound himself in order to support a charge of attempted murder; in cases of homicide, the murderer may inflict wounds on himself to give to the occurrence the appearance of a fight and that he acted in self-defence. It is not uncommon for persons who have stolen money or valuables left in their charge, to allege that they were attacked and overpowered by robbers, and in support of the statement to point to wounds on their person. In India, murders of a very extraordinary type occur. It is an undoubted fact that individuals have deliberately offered themselves to be killed, in order that an enemy might be charged with the the crime. Cases of this description could only be solved by the circumstances; the injuries would be homicidal, but would throw no light on the peculiar character of the crime.

Self-inflicted injuries are generally superficial or, if deeper, avoid those parts known to contain vital structures. They are often numerous, scattered over different parts of the body.

A feigner will seldom cut boldly through the clothes into the flesh; as a rule, the cuts on the clothes are done separately, and in consequence, may not correspond in position and direction with the wounds.

The following instance occurred last year in Howrah. A man and woman came to hospital, in charge of the Police. They stated that on the previous night, while asleep, four men entered their hut, seized and tried to kill them ; the woman by strangulation with a cord and cutting the throat, the man by the last mentioned method only. On the neck of the woman, there was a broad black mark, extending from the front obliquely backwards on both sides as far as the angle of the jaw. It had the appearance of a mark caused by some dye. Below the mark there was a long skin cut, on the left side it penetrated and involved a mass of caseating glands, which were discharging by an old sinus, elsewhere the cut was quite superficial. On the man, there was a long skin cut running obliquely from left to right, across the throat. Near it there were short incisions. Neither the long cut nor the short ones divided the skin completely ; they just drew blood and no more. It will be observed the woman's wound divided the skin at one part, it is probable that the man made it, and was less careful of her than he was of himself.

CHAPTER XIV.

BURNS AND SCALDS.

Burns are injuries caused by the local application of dry heat in the form of flame, heated solid substances, or radiant heat; scalds result from the action of moist heat, hot fluids, or steam. The injuries caused by molten substances and corrosive fluids are usually termed burns.

The effects caused by the local application of heat, depend on the temperature and duration of the exposure. A heat less than that required to produce a burn causes congestion, redness, tingling and pain, which subside soon if the heat be removed, but the long continued application to the whole of the body of heat of this degree may cause death. The following instance was reported by Speck in 1874. A girl suffering from chronic joint disease was, on the advice of a quack, wrapped in a sheepskin removed from the warm carcase, laid in bed, surrounded by loaves taken hot out of the oven, and covered with bed clothes. She fell asleep, perspired very much, and in three hours died. At the post-mortem examination, the body was found to have decomposed with great rapidity.

Heat of a greater degree causes vesication, due to the exudation from the vessels of the cutis. A still higher degree of heat, or longer exposure, causes destruction of the cuticle and portion of the cutis, great pain is produced, as the nerve endings are involved, but not destroyed. Violent heat causes complete destruction of the skin and tissues to a varying depth. The whole thickness of a part may be destroyed and charred, transformed into a dead mass, which if the individual survives, is separated by ulceration in the same way as in gangrene.

The danger to life from a burn or scald depends on the extent of surface involved and the situation rather than on the depth of the injury. An extensive burn over the abdomen, affecting only the skin, is more likely to cause death than a deep burn confined to a small area, and situated on a leg or arm. If more than one-third of the surface of the body be involved even though the burn is superficial, death usually occurs.

When an individual sustains an extensive burn, he is thrown into a condition of collapse, which may end fatally within a few hours, or more gradually, after twenty four to forty-eight hours. If the patient survives, reaction sets in, accompanied by inflammatory fever, and death may result from this cause in two or three days, or more often, from inflammation of the internal organs or of the serous membranes. In some fatal cases of burns, the post-mortem appearances are not sufficient to account for death. The patient has survived the period of shock, and has died two or three days after the injury. Different theories have been put forward to account for these cases. Some pathologists hold that a large quantity of blood was damaged in the burnt area, and that the red cells were rendered incapable of carrying oxygen to the tissues. Others believe death to be due to the interference with the function of a large area of the skin and consequent accumulation of excrementitious products which poison the system. This theory gains support from the fact that in many of these cases marked congestion and inflammation of the kidneys have been observed.

If the burn has resulted in the destruction of tissues, the patient may die, during the process of separation of the dead parts, from septic absorption, or from exhaustion.

Children are much more susceptible to the effects of burns than adults, a comparatively small superficial burn may cause fatal collapse in a child.

POST-MORTEM APPEARANCES IN DEATH BY BURNS AND SCALDS.

If the heat resulted only in congestion and redness, these signs disappear completely after death by the gravitation of the blood, and the skin, except in the dependent parts, becomes pale. No mark of the burn may be found, or there may be slight roughness of the epidermis, and slight yellow discoloration of the part, but these signs if found, are not sufficient to make a diagnosis for medico-legal purposes, moreover they may be produced by disease, injury, and other causes.

If the burn caused vesication, the blebs will be found after death. Vesication may be due to other causes ; blisters are produced in some diseases, also by medicinal applications, pressure and friction.

A blister produced during life by heat or other means, presents the following characters :—It is tense, distended with serum, rich in albumen, the floor is usually red and injected, and frequently marked by small extravasations of blood, due to the rupture of overdistended capillaries. The floor may become pale after death by the gravitation of the blood from the congested vessels but as a rule, some portions remain injected, owing to the blood having been coagulated in the vessels by the heat, or other means which produced the blister.

After death, the application of heat may cause a separation of the cuticle and the formation of a bleb. I may add that I have never succeeded in producing this result, though on several occasions the experiment was made on bodies still warm and dead less than an hour. What I found from the application of the flame of a spirit lamp, was that the hairs were burnt and the cuticle destroyed, so that it was easily rubbed off. There was not the slightest sign of the formation of a bleb. A post-mortem bleb could only contain gas and watery vapour ; there could be no congestion of the vessels.

Casper made many experiments on dead bodies and was seldom able to produce a blister, and those formed contained only watery vapour ; Von Hofmann states that even ten minutes after death, a blister having the characters of one caused during life, could not be produced. With regard to burns of a more serious type involving destruction of the skin and tissues, those of vital origin may be distinguished by a zone of congestion around the affected area, and the presence of coagulated blood in the vessels and injection of the tissues. If the parts were burnt after death, no zone of congestion would be formed, and the burnt tissues would contain no blood. Complete charring of the tissues destroys all signs by which vital and post-mortem burning can be distinguished, but unless the whole body is equally involved examination of the less affected parts will enable the diagnosis to be made.

The effects produced by corrosive fluids are distinguished from burns caused by heat, by the colour of the surface, the absence of vesication, blisters are never produced by corrosives, and by the unscorched condition of the hair ; Sulphuric Acid colours the skin brown, nitric acid stains it yellow.

Death from burns is generally accidental, but suicidal and homicidal cases also occur. Chevers mentions the practice by dacoits, of roasting persons over a fire until they gave information regarding their property ; death not infrequently resulted from the injuries caused. Houses have been set on fire with the object of burning the inmates to death. People have been burnt to death under various circumstances. Suicide by burning is sometimes resorted to by lunatics.

Not infrequently, the bodies of individuals, killed by other means, are got rid of by cremation. I have examined one partly consumed body ; the history was to the effect that the deceased had been killed by her husband. The two had quaralled, the man picked up a piece of firewood and struck his wife on the side of the head. He did not intend to kill her, and when he saw she was seriously injured, did all he could for her. She died the next day, and the body was taken to the burning ghat. Meanwhile information of the occurrence was received by the police, who went to the ghat and stopped the cremation, but not before the body had been partly consumed. The arms and legs were almost completely destroyed. The flesh generally had a cooked appearance. The skin had burst in many places. The hair was completely burnt, portion of the scalp was destroyed, what remained was thoroughly cooked. In the left temple, there was a mass of extravasated blood, brown in colour, beneath it a circular opening in the skull. The edges were white and showed no trace of blood staining. The brain was shrunken, the dura mater flaccid ; there was no sign of extravasation of blood within the skull.

Before the Magistrate, I stated that the bruise in the temple was caused during life, but as regards the hole in the skull, I could not give a positive opinion as all signs of the vital origin of the fracture were absent.

When bodies are discovered in a house, which has been burnt down, the post-mortem appearances may show that death was due to suffocation, or to poisoning by carbon-monoxide. The following is an example of the latter. A hut containing straw took fire, the two inmates rushed out, unfortunately one returned to save some property, and was overcome by carbon-monoxide. There were several large superficial burns on the body and typical appearances of carbon-monoxide poisoning.

The inmates of a burning house may be killed by injuries from falling beams or other causes.

Spontaneous Combustion.

There was, at one period, a general belief in the possibility of the spontaneous combustion of the living body, and there are cases recorded, which, if the evidence regarding them could be accepted, would appear to prove that the process does occur. But the recorded cases were first observed by persons of no medical training, and only afterwards by medical men, who it is reasonable to suppose, had not had much experience of death by burning. It is a notable fact that in the present day, no case of supposed spontaneous combustion is ever heard of. The known facts regarding the combustibility of animal tissues, even when soaked in alcohol, are strong evidence against the possibility of spontaneous combustion of the living body. It is probable that the recorded cases are instances of rapid decomposition with the generation of inflammable gases which accidentally, or perhaps spontaneously, took fire.

The medico-legal interest of the subject lies in the fact that spontaneous combustion has been put forward as a defence in cases of murder in which attempt was made to destroy the corpse by fire.

Death from Electricity.

Since the introduction of electricity for lighting, traction and other purposes, numerous accidents, fatal and non-fatal, have occurred, many of them owing to the ignorance or carelessness of persons using this dangerous agent, others from faulty construction of the apparatus for generating and conducting the current.

The effects produced by the passage of an electric current of high power through the human body are exceedingly variable; death may be caused instantly, or within a few minutes, in other cases no effect is produced, or serious though not fatal consequences may result. These variations depend on the nature of the current, and on the resistance of the body. It is found that a rapidly alternating current is much more dangerous than a continuous current, also, that the opening current of an induction coil is much more intense, though of a shorter duration, than the closing current.

As regards individuals, men have been killed by a current, which had no serious result on others. It is impossible to estimate the effect of a current on an individual, as the resistance of the body varies.

A slight electric shock causes pain, tingling and numbness. The passage of a strong non-fatal current through the body produces a condition of tetanic rigidity, the individual falls and may or may not lose consciousness. He may recover completely within a short time, or the shock may set up symptoms similar to those which sometimes follow when a person has been exposed to great danger, though he has escaped all apparent injury. He may experience anomalous pains, dizzinesss, disordered vision, tremors, restlessness, a feeling of apprehension, and a dread that his health has been permanently injured. These consequences are more likely to result in individuals of a nervous temperament. The medical jurist called upon to examine a case of this kind, has to keep in mind that the symptoms may be exaggerated or feigned, with the object of obtaining damages from the persons responsible for the accident.

An electric shock may render the individual apparently lifeless. There are many cases of persons struck by lightning and apparently killed having been resuscitated. The shock produces a condition of cardio-respiratory inhibition.

A powerful current may produce loss of consciousness, followed by coma with tonic and clonic convulsions and delirium. These symptoms may continue for hours and end either in recovery or death.

The passage of an electric current through the body may result in severe injuries, extensive burns, lacerations of tissues, rupture of organs and fracture of bones, but death may be caused without any mark of injury on the body, or internal lesions only may be found.

The following cases of death by lightning illustrate the above remarks :—The police report states that the deceased men were sheltering under a tree during a thunderstorm, when both were struck dead by lightning. A third man standing near them was severely injured.

The post-mortem examination was held 19 hours after death.

The body of Matabik was clothed with a cotton coat and dhoti. The right sleeve of the coat was extensively torn, and scorched. The dhoti was also torn and slightly scorched. Death rigidity was present. The left eye was open, the right closed, the pupils equal and of medium size. There was a small lacerated puncture on the right cheek, close to the zygoma which was fractured. The wound was not scorched. On the right shoulder, there was a row of small abrasions ; on the right side of the chest extending down to the right great trochanter, a broad red mark, abraded above. The hair on the front of the chest and abdomen, and along the back of the left thigh and leg down to the ankle, was scorched. The internal organs were congested, the blood fluid ; both sides of the heart were full of blood.

On the body of the other man, there was not the slightest mark of the lightning; the clothes were intact and unscorched. The blood was fluid and both sides of the heart were full. The internal organs were slightly congested. The third man was severely burnt, and his right leg broken. He recovered.

The death of the second man may possibly have been caused by what is called the "return shock." The passage of the lightning from the cloud through Matabik may have caused the charging of the body of the second man with an induction current, subjecting him to a slight closing shock, and immediately after the passage of the lightning, to an opening current of much shorter duration, but of great intensity and sufficiently powerful to cause death.

On the skin of persons struck by lightning, markings of an aborescent, branched character are sometimes found. They were at one period thought to be a kind of photograph of trees or similar objects near which the individual was standing when struck. They are simply the marks caused by the electricity in its course along the skin.

HEAT-STROKE.

Heat-stroke is a condition caused by exposure to excessive heat. It may be produced by the direct rays of the sun, or in the shade, during hot weather, especially if the air is moist, and in close, hot, badly ventilated rooms. The effects produced by exposure to excessive heat vary; in some individuals, a condition of collapse is caused, characterised by extreme prostration, restlessness, rapid weak pulse, feeble respiration. The skin feels cold and the temperature may be sub-normal, as low as 96° or 97°. In fatal cases, coma sets in and death follows. In some instances, the patient may fall down and die instantly, or within a short time. This type is known as Heat Exhaustion, and it seems particularly likely to occur when individuals are working in confined, badly ventilated places. It may also follow exposure to great artificial heat; the engineers and firemen on board steamers in the tropics are not infrequently prostrated by heat exhaustion.

Sun-stroke affects persons exposed to the direct rays of the sun. The symptoms are head-ache, dizziness, a feeling of oppression, nausea, vomiting. Insensibility follows, which may pass into profound coma. The temperature is very high, eight to ten degrees above normal, skin, hot, dry, pungent, breathing stertorous, face flushed. Convulsions may occur. The pupils may be contracted, but, as a rule, dilate before death. The pulse is weak and rapid. In fatal cases, coma becomes profound. Death may occur rapidly, or more usually, in twelve to twenty-four hours. A powerful European struck down in the streets of Calcutta during the month of May, was completely unconscious and had a temperature of 110° Fah. on admission. Death occurred in twenty-four hours.

The post-mortem appearances are not characteristic. Heat may be retained for an unusual time. The blood is fluid, the right side of the heart distended. The lungs may be extremely congested. The brain is not, as a rule, much congested.

Recovery from heat-stroke may be imperfect, the individual may suffer form headaches and may exhibit marked susceptibility to the effects of heat. In some cases signs of mental derangement come on and progress to marked insanity.

DEATH FROM COLD.

In India, death from cold is only likely to occur in the Himalayas and North-Western parts of the Punjab. Great cold has the effect of lowering and finally extinguishing all vital activity.

New born infants and young children are very susceptible to cold. The aged and emaciated, and persons addicted to alcohol, are less able to withstand the effects of cold than well nourished temperate adults. Exposure to extreme cold produces exhaustion, a feeling of languor, the limbs seem heavy, there is a desire to sleep, which after a time becomes irresistible, the individual sinks in to a state of stupor, his mind is confused, there may be delirium and hallucinations. The stupor deepens into coma and death occurs.

The post-mortem appearances are variable. There are generally patches of frost-bite on the exposed parts of the body. The internal organs are congested. The blood may be unusually red owing to changes in the hæmoglobin. But these signs are not constant. The cause of death can, as a rule, only be inferred from the circumstances.

DEATH FROM STARVATION.

Deaths from starvation are divisible into two classes ; the first includes cases of acute starvation, when healthy well nourished persons are suddenly deprived of food; and the second, individuals who for a long period, months or years, have subsisted on insufficient food ; cases of the second kind are frequently met with in India, during times of famine. In 1896, I examined several cases of this description.

In acute starvation, death generally occurs before extreme emaciation has taken place. The body may appear fairly plump, and there may be a considerable quantity of fat beneath the skin, in the omentum, and in other situations. The stomach and small intestines are empty or contain some mucous, scybalous fæces may be found in the colon. There are great differences in the post-mortem appearances, in some individuals emaciation occurs rapidly and reaches an extreme degree before death. From acute starvation, death generally takes place in eight or ten days, but there are many recorded instances of survival for much longer, and even when the surrounding circumstances were very unfavourable.

The fasting men, Dr. Tanner and others, lived without food for forty days and upwards, without apparently any permanent ill-effects. A prisoner at Toulouse, who voluntarily starved himself to death, lingered for fifty-eight days; he drank water and urine, there were convulsions for several hours before death. Deprivation of water and food causes death much more rapidly than want of food alone.

In the cases of chronic starvation met with in India, in famine years, emaciation is extreme. The individual is a walking skeleton, his limbs are of the same thickness throughout, his face is cadaverous, the eyes are sunken, staring, the pupils generally dilated. There is a very offensive and peculiar odour from the body, the skin is harsh, dry and scurfy.

On post-mortem examination, no trace of fat is found in any part. The muscles are small, the flesh pale and soft. The heart is devoid of fat and small; the tissue on the surface which normally contains fat is pale and has watery œdematous appearance. The blood is watery, the clots pale, jelly-like. The stomach is usually large and may be much dilated. The walls are thin and the mucous membrane is pale and granular. In one case, I found a quantity of clay in the stomach. The small intestine is empty and so thin as to be transparent.

The coats of the intestine are atrophied, the mucous membrane is reduced to the thinness of paper, and may have completely disappeared. Serous fluid may be found in the peritoneum, pleuræ, and pericardium. There is generally an excess of serum in the ventricles and spaces of the brain. The liver and spleen are small. The substance of the liver and kidneys is granular.

It is evident that when emaciation and the atrophy of the digestive tract have arrived at the stage above described, the individual cannot recover. This was the experience in the Campbell Hospital in 1896, when large numbers of famine-stricken people from the North-West Provinces were admitted. The mortality was very great.

CHAPTER XV.

POISONS.

No subject in medical jurisprudence is of greater interest and importance to medical men in India than that which deals with poisons. In the oldest writings and in the records of the present time, ample evidence is afforded of the extensive knowledge of the effects and the methods of using many powerful poisons, possessed by the people of this country of all classes.

In ancient India, poisoning appears to have been commonly resorted to for the removal of enemies, political and other rivals, discarded favourites, and troublesome persons of all kinds; some writers have suggested that the custom of Sati, or the burning of Hindu widows, was devised to put a stop to the poisoning of husbands by wives, and though this view is not accepted by many authorities, the records show that in former times methods of poisoning were well known and frequently employed in this country.

In the present day, poisoning, homicidal, and suicidal, is much more common in this country than in England; the Chemical Examiners to the Government of Bengal, the late Major Evans and Dr. Chuni Lal Bose, Rai Bahadur, in their valuable paper on "The necessity for an act restricting the free sale of poison in Bengal," read at the Indian Medical Congress in 1895, show from the recorded cases that "murder by poisoning is three times as prevalent and suicide by poisoning many times more prevalent than in England."

There is a general, and I consider well founded, belief that murder by poison is much more common in India than the recorded cases indicate, and that many crimes of this description are never discovered, or if discovered and the fact that death was due to poison proved by the post-mortem examination and analysis of the viscera, the difficulties of obtaining reliable evidence are so great that the attempt to discover the criminal has to be abandoned.

Among the cases of poisoning, which I examined in the last seven years, there were several of a very suspicious character, one may be described, it shows the difficulties the police have to contend with in investigating a case of poisoning.

In May 1897, I was requested to examine the body of a woman, aged 30 years; the police report stated that the deceased was said to have suffered from pain in the stomach for some time, and on the day of her death to have been attacked with vomiting and purging. Doctors were called in and prescribed for her, but she died shortly after. The police received information, anonymously, that the death was suspicious, probably due to poisoning. They inquired of the medical men who had attended the deceased; these gentlemen stated that they found the woman collapsed, as would be seen in cholera, and they believed the death to be due to that disease.

The people of the house, connections and relations of the deceased, declared she died of cholera, and protested against the body of a woman of high caste, belonging to a family of standing, being subjected to the indignity of a post-mortem examination.

When I arrived at the morgue, the body was not there, and I then learnt that the relations had gone again to the Commissioner of Police to protest against a post-mortem examination being made. After some delay, the body was brought, and on examination, undoubted signs of arsenic poisoning were found; the Chemical Examiner recovered thirty grains of arsenic from the stomach.

An inquest was held, the Coroner, Dr. E. W. Chambers, examined every available witness, and kept the inquiry open for weeks, nothing was discovered beyond the fact that the woman died of arsenic poisoning. In the house, the police found a curry stone on which the Chemical Examiner detected arsenic. During the inquiry, it came out that in the family, there had been three brothers, joint owners of great wealth, ten or twelve lakhs; all the brothers had died childless, leaving three widows, the deceased was the widow of the youngest brother. About a year previously, the widow of the second brother had obtained an order from the High Court, for the payment of a monthly stipend for her own use, soon after obtaining it she died suddenly, it was said, of cholera, and the body was duly burnt. The third brother's widow was away at the time, at Benares, and did not return to Calcutta until about a month before her death. She expressed her intention of applying for her share of the property, but before she had taken any steps in the matter, was taken ill and died within a few hours, from arsenic poisoning, not, as stated by the relations, of cholera. There was no suggestion advanced that she had committed suicide ; there seemed no reason for her doing so. An open verdict was returned, and there the matter ended.

Arsenic may be purchased in every bazaar ; it is not infrequently kept in houses to destroy rats, and other vermin, women, though not as a rule, those of the respectable class, use it as a depilatory. It is also used as an aphrodisiac.

In the paper referred to, Major Evans and Dr. Chuni Lal Bose have gone as fully into the statistics of poisoning in Bengal as the defective records permit ; and they have clearly shown the necessity for an act to restrict the sale of poisons, more especially of arsenic, which is the homicidal poison. They have given examples of homicidal, suicidal and accidental poisoning, due to the absence of this safeguard, and have shown that the objection put forward that as vegetable poisons abound, and can be obtained from every jungle and in almost every garden, an act would be valueless, is contrary to experience. They show that the number of indigenous vegetable poisons, generally known, is small, and that most of the deaths caused by them are suicidal or accidental, and that they are not suitable for the purposes of the poisoner. The records prove that throughout India, arsenic is the poison, almost invariably, selected by the poisoner. The reason is evident; the people of this country are well acquainted with the effects of arsenic, they know that it has neither taste nor odour, the quantity required is small, its administration in food or drink is easy, and the symptoms produced so closely resemble those of a common and rapidly fatal disease that even an experienced medical man may be deceived. Vegetable poisons in the crude and generally only available condition are uncertain in their action, have an acrid or bitter taste, must be given in large quantity, and produce symptoms which are generally distinct from those of disease.

Accidental poisoning is common, a fact, which is not surprising to a person who is cognisant of the recklessly careless way poisons of the most powerful kind are kept in shops and private houses. Some years ago, fifteen persons were taken to Hospital for the treatment of arsenic poisoning, one, a child, died. It appears, there had been a feast in the house of one of the party, at which a quantity of sweetmeats were consumed. It was discovered that at the shop where the ingredients were purchased, arsenic was kept for sale, on a shelf, loosely wrapped in paper, and immediately beneath there was an open vessel containing sugar, and from that vessel sugar for the feast was supplied.

I have examined the bodies of children poisoned by opium which they had taken from the opium box belonging to one of the household, and carelessly left where the child could get at it. A child was poisoned by arsenic, which she picked up from the floor. A man brought his two little sons to hospital for the treatment of strychnine poisoning. He stated that he had, by mistake, given them strychnine for santonine. Fortunately he discovered his error at once, and caused the children to vomit. Under treatment both recovered. When I asked the man how he came to have strychnine, he replied that he had two young wives. In connection with a peculiar case of suicide by cyanide of potassium and hanging, I had occasion to inspect a passari's shop, of which the deceased was the proprietor. The premises consisted of two small rooms, the front one, on the street, was the shop, the back room was used as a store room. In the shop, there were for sale condiments and spices of various kinds, and on the same shelves, open tins and earthenware vessels, containing various poisonous substances, nux vomica beans, aconite root, arsenic, and many bottles, some labelled, others without a vestige of a label, of cyanide of potassium, nitric acid, strong ammonia, hydrocyanic acid, strychnine and other dangerous poisons ; no doubt the proprietor knew the contents of the bottles but in his absence, the person taking his place would be very liable to make a mistake.

The use of various substances for their supposed aphrodisiac effects is very common. No doubt many of them are harmless ; some of the concoctions that have been described to me must be very peculiar and disgusting ; but many powerful poisons are in use for this purpose, arsenic, nux vomica, strychnine, dhatura, Indian hemp, opium, and, of late, cocaine has become a special favourite in Calcutta. The above list is not exhaustive, it includes the principal dangerous substances of repute as aphrodisiacs in Calcutta.

Love-philtres are also believed in, many, probably most, are harmless, and rather quaint concoctions, but in some arsenic is used. Evans and Bose mention the case of a man who unintentionally poisoned his wife by administering to her a love-philtre mixed with sugar, it contained arsenic. The concocter, probably a fakir, or a wise woman, put in the arsenic for its aphrodisiac qualities. In cases where a man or a woman is accused of having poisoned the wife or husband, the defence is sometimes put forward that the substance given was love-philtre, with the poisonous qualities of which accused was ignorant.

The following occurrence illustrates a not very uncommon feature of criminal poisoning in India, and exhibits a callousness and disregard for life which are most striking. A Brahmin, the mohunt of a temple, had been in enmity with a man and determined to kill him. For this purpose, he pretended to make up the quarrel, and some time after, invited a large number of people to a feast, including his former enemy. He distributed certain articles of food himself, a high honour, and all partook of them. Shortly after, all were taken ill with vomiting and purging and 25 died. At first, it was thought that this dreadful occurrence was due to some accidental poisonous quality of the food, but when the viscera and certain articles of food were examined, arsenic in large quantity was found. The inquiry led to the conviction of the Brahmin.

It is unnecessary for legal purposes to attempt to define the word poison. In the Indian Penal Code provision is made for the crime of poisoning; in Section 299 it is stated that "whoever causes death by doing an act with the intention of causing death, or with the intention of causing such bodily injury as is likely to cause death, or with the knowledge that he is likely to cause death, commits the offence of culpable homicide."

It is manifest that the administration of a substance with the intention of causing death and with the result that death was caused thereby would come under the definition of culpable homicide; and it is quite immaterial whether the substance which caused the death was one which would be called a poison or not.

Section 324 deals with voluntarily causing hurt by dangerous, weapons, "or by means of any poison or any corrosive substance, or by means of any explosive substance, or by means of any substance which it is deleterious to the human body to inhale, to swallow, or to receive into the blood, or by means of any animal," and Section 326 provides for voluntarily causing grievous hurt by dangerous weapons or by the means mentioned in Section 324.

The administration of poison with the intent to hurt or with the intent to commit or to facilitate the commission of an offence is dealt with in Section 328 which states that, "whoever administers to or causes to be taken by any person any poison or any stupefying, intoxicating, or unwholesome drug, or other thing, with intent to cause hurt to such person, or with intent to commit or to facilitate the commission of an offence, or knowing it to be likely that he will thereby cause hurt, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine.

The Indian Penal Code has provided for murder by poisoning, for non-fatal poisoning, and for drugging to facilitate crime. For medical purposes, a poison may be defined to be a substance which, when administered in a relatively small amount, injures or causes death. The quantity required to produce poisonous effects varies with the substance, but there is no substance which can be called an absolute poison, that is, poisonous under all conditions and in all quantities. Every poison, even the most potent, must be given in an appropriate dose in order that it shall poison. The quantity may be very small, as for example, strychnine in a dose of half a grain has proved fatal, but in minute quantities it is a valuable therapeutic agent.

Substances to which we apply the word poison will act as such only when given in a certain dose, the size of which depends on various factors. The dose varies with the substance. Some poisons are much more potent than others, half a grain of strychnine has killed, the fatal dose of arsenic is two grains, of opium four grains, of sulphate of copper about one ounce. The fatal dose of these four substances, all of which are poisons, varies from half a grain to about one ounce. By the fatal dose is meant the smallest quantity of a substance which has caused fatal poisoning in an adult.

There are other very important factors which modify the effects of a poison. They may be divided into those that concern the poison directly, and those that belong to the individual. As regards the factors of the first division; of great importance are the physical condition of the poison and the mode of administration. A substance, which in the pure state is a powerful poison, may have its effects greatly lessened or altogether prevented by dilution, pure sulphuric acid is most destructive to the tissues; diluted, its effects diminish in proportion to the dilution. A weak solution of sulphuric acid in water has no destructive action.

Many of the active vegetable poisons lose their poisonous effects by keeping, owing to the evaporation of the volatile substances on which their activity depends. As a general rule a freshly prepared substance is more active than the same if kept, or if used in a state of dilution.

A poison in solution acts more rapidly than if given in the solid state, and if the substance, which in its usual solid form is only slowly dissolved within the body, be made into a solution before administration, its action is greatly expedited, and its effects may be altered; and if the substance be capable of assuming the gaseous form, the rapidity of its action is greatest in this state. In illustration of the above statements, arsenic may be mentioned; as commonly used in India, it is administered coarsely powdered in food, and is slowly dissolved in the stomach, the rate of solution is so slow that, as a rule, particles of the poison are found in the stomach after death, the long continued presence of the arsenic in the stomach accounts for the marked signs of irritation which are seen. If before administration the arsenic be dissolved, absorption is rapid. Symptoms come on qiuckly and the signs of irritation in the stomach are less; arsenic in the form of arseniuretted hydrogen is still more rapid and powerful.

The vehicle in which a poison is given is of great importance. If the poison is soluble in the vehicle its action is increased and expedited. The vehicle may retard the action of the poison, or may destroy altogether its poisonous effects. The administration of a poison in a large mass of food retards its action, as the presence of the food around the poison will prevent it coming in contact with the stomach wall. The vehicle may directly diminish, or even destroy the poisonous qualities of the substance. If corrosive sublimate be administered in an albuminous solution its poisonous effects are destroyed by its combination with the albumen. Most alkaloids are precipitated by tannin, consequently if administered in tea or coffee their effect is diminished or prevented. The vehicle may have a chemical effect on the poison by which its qualities may be altered, increased or diminished.

The channel by which poison is introduced into the body has a modifying effect on its action. The most common route for administering poison is by the mouth. In a few instances, the rectum or vagina has been the channel of administration. Poisons have also been given by hypodermic injection.

A poison in solution acts most rapidly if injected into the circulation, less rapidly by injection into the cellular tissues. Some poisons, the various poisonous gases, enter through the respiratory tract. Absorption through the unbroken skin is the slowest mode of introducing a poison into the body but it does occur as we find in cases of poisoning by carbolic acid resulting from the application of antiseptic dressings over a large area, and from the effects of the application of various vegetable extracts to the skin over parts affected with rheumatism. Injection of a poison into the circulation is necessarily the most effective mode of introduction, for it insures that the whole dose is circulating in the blood at the same time, whereas if the substance is introduced into the stomach, some time is required for absorption, and elimination may have begun before the whole of the poison was absorbed from the stomach. Consequently at no time would the whole dose be circulating in the blood.

The factors belonging to the individual which modify the effects of a poison are age, state of health, idiosyncracy, and habit.

AGE—As a general rule, poisons have more effect on the young and the old than on persons of middle age. Children are generally affected by disproportionally small doses of poisons, and towards some substances they exhibit a special susceptibility, for example opium ; on the other hand towards belladonna, they show a disproportionate tolerance.

Idiosyncracy.—When an individual exhibits a special susceptibility or a special tolerance towards a particular substance, we ascribe it to idiosyncracy. There are many persons who exhibit a marked idiosyncracy to certain articles of food which most people make use of without any untoward consequences. A considerable number of people cannot eat shellfish, pork, duck, mushrooms, onions, or various other articles of food, without exhibiting symptoms of poisoning. To such persons certain articles of food are poisons. As regards poisonous drugs, individuals may exhibit an idiosyncracy, and medicinal doses of a particular substance may produce poisonous effects. The drugs towards which individuals most frequently exhibit an idiosyncracy, are iodide of potassium, arsenic, lead, mercury, and various vegetable substances. As a rule, the idiosyncracy is confined to one substance.

Much rarer is a special tolerance towards a particular substance, but it is sometimes met with. Its discovery can only occur by accident, so that possibly, it is more common than would appear from the recorded instances.

Christison relates the case of a gentleman, unaccustomed to the use of opium, who took 450 drops of laudanum without any marked effect.

Idiosyncracy is a congenital condition, it is to be distinguished from the effects of habit. An individual who possesses an idiosyncracy towards a particular substance can, without previous habituation, take a poisonous quantity of it, without toxic effects being produced.

Habit.—In regard to certain substances, it is found that regular use gradually produces an acquired tolerance, so that the individual, after a time, takes, with impunity, a quantity which would have produced fatal poisoning had he taken it before tolerance was acquired by the gradual adaptation of the system to the action of the poison. In this country, the influence of habit on the effects produced by drugs is frequently observed. Opium eating is a familiar example, the opium eater (not all, probably, not more than a small percentage) gradually increases the daily dose of the drug, and after a time can take, without poisonous effects, a quantity which would be sufficient to kill several persons unaccustomed to its use. The effects of habit are seen in tobacco smoking, in the consumption of alcohol and other substances in common use.

State of Health.—A strong healthy individual is less likely to succumb to the effects of a poison than a person in feeble health, but as regards some poisons, the presence of disease increases the tolerance of the individual. A man suffering from an acute painful disease, for example dysentery, can take a quantity of opium which would poison him in his normal healthy condition. A person with diseased kidneys is particularly susceptible to mercury. I have seen fatal poisoning, from a medicinal dose of mercury, in an individual whose kidneys were found in the post-mortem room to be much diseased.

The condition of the individual's stomach, at the time the poison was taken, has a considerable influence on the symptoms. A full stomach retards the action of the poison and may make absorption so slow that, although a fatal dose was taken, the quantity at one time in the blood may be insufficient to cause death. An empty stomach favours the action of the poison as the whole amount taken comes at once into contact with the surface of the stomach and is quickly absorbed. Diseased conditions of the stomach may retard the action of a poison ; a condition of chronic dyspepsia, in which the mucous membrane is in a sluggish state and covered with tenacious mucus, must interfere with the absorption of a poison.

CHAPTER XVI.

DIAGNOSIS OF POISONING.

The diagnosis of poisoning in the living concerns particularly practising medical men, and in India, every practitioner may expect to be called upon to treat cases of poisoning frequently, not, as usually falls to the lot of a medical man in England, a few times in his career. It is, therefore, especially incumbent on medical men in this country to be thoroughly acquainted with the symptoms produced by poisons, in order that by correct diagnosis, they may be in a position to apply the treatment appropriate to the case, and also, in criminal cases, that they may assist justice in the punishment of the poisoner.

In the present chapter it is proposed to consider the features which characterise cases of poisoning generally, and assist in distinguishing them from natural diseases. In later chapters the symptoms of each important poison will be separately considered.

Medical men do not, as a rule, see the early symptoms produced by a poison, and when called in, have to rely on the statements of the patient or of those around him for an account of the beginning of the illness. This is an unsatisfactory circumstance, but of course it is not confined to cases of poisoning. Medical men are rarely sent for, except when gratuitous service is available, in illness of any kind until the progress of the symptoms or their painful character has created alarm in the patient or in his friends. But in poisoning cases, there is a special difficulty ; in a natural illness both the patient and his friends have every desire to give a faithful description of the symptoms, and though they may give an erroneous account they have no reason to deceive. In cases of poisoning the circumstances are different, and very often the information given to the medical man is purposely incorrect, the object being to avoid a police inquiry by inducing him to consider the case to be one of a natural disease. This course is especially likely to be adopted if the case is one which the friends consider hopeless ; for example, a man was discovered in a moribund state. His relations sent for a medical man to whom they gave an account of the patient's illness which indicated that he was suffering from disease. The state of the patient was such as could have been caused either by narcotic poison or by disease, and the medical man was disposed to consider the case one of apoplexy, but it happened that in moving the patient, a large piece of opium was found in the bed, and traces of the same substance on the fingers. Then the friends acknowledged that they had found on the patient's person a letter, in his handwriting, in which he declared his intention of committing suicide by opium. In cases of homicidal poisoning, it may happen, if a medical man is sent for, the persons who give him information, are concerned in the crime, and it is to their interest to prevent a correct diagnosis being made, an instance of this has been mentioned on a previous page.

It must be acknowledged that medical men sometimes exhibit an extraordinary credulity with regard to the statements made by people concerning the illness of a person who, when seen by the practitioner, is in a collapsed, moribund condition, and there can be no doubt that medical men have been induced by improper considerations to lend their assistance in hushing up a matter which should have formed the subject of a judicial inquiry. It is, no doubt, quite exceptional for medical men of any description to join in the concealment of a homicide, but as regards suicidal and accidental deaths by poisoning and other means, medical men are sometimes persuaded, by the entreaties of the relations to be saved from the publicity and unpleasantness of a police inquiry, into granting a certificate of death from natural causes.

The early and correct diagnosis of the nature of the complaint from which the person is suffering is of the greatest importance, and failure may result not only in the death of the individual but also in the escape of a criminal. At the same time, it must be acknowledged that to distinguish poisoning by certain substances from acute diseases may be extremely difficult, and there can be no doubt that murder has been committed with impunity, even when a medical man has been in attendance on the case. In India, no difficulties exist in disposing of a dead body, the custom among the larger portion of the people is to burn the dead, a process which is carried out with little delay, a necessity in this climate, and which effectually removes all trace of poison. In the capital cities an imperfect system of registration of deaths exists, but a medical certificate is not essential, nor is it feasible, at present, to require one, even in the large towns ; and, of course, in mufussil districts it would be, and is likely to continue to be impossible to avoid accepting the statement of friends and relations as to the cause of death.

Writers on medical jurisprudence have directed attention to certain general features of poisoning, which are of assistance in distinguishing it from disease. In poisoning, the onset is generally sudden, and the individual up to the moment of the attack has been in his usual health. It must not be overlooked that a sick man may be poisoned. The symptoms appear soon after the ingestion of the poison, which, in homicidal cases, is usually introduced in food, or drink, or in medicine. In some poisons the effects are perceived immediately, there is no interval, the corrosives are the most striking example, but these substances are seldom used in homicidal poisoning ; with other poisons there is an interval, the length of which depends not only on the substance and its solubility, but more especially on the state of the stomach as regards contents, a quantity of food in the stomach retards the action of a poison and modifies symptoms.

The course of poisoning is usually rapid, the symptoms increase quickly, and, as a rule, the termination occurs within twenty-four hours. These characters are observed in cases of acute poisoning, due to the ingestion of a large quantity of a poison. In those cases, in which poisoning is due to the long continued administration of minute doses which produce poisonous effects by cumulative action, the onset is gradual, the symptoms increase slowly and the course is prolonged.

In India, probably more than in other countries, sudden attacks of rapidly terminating diseases are often met with, and one of the commonest of these acute affections frequently seizes upon persons who are in good health up to the moment of the attack.

When a number of persons, after partaking of the same food are attacked with similar symptoms, the circumstance is very suspicious of poisoning. In a previous page, examples were given of poisoning of a number of persons by arsenic introduced into food, instances of the same kind in which other poisons were mixed with food could be mentioned.

On the other hand, cases are recorded of a number of persons being attacked by the same disease soon after eating, and there is no doubt that disease germs may be introduced in food or drink. Nevertheless, if a number of persons present the same symptoms soon after taking the same food, the fact is very suspicious of poisoning and steps should be taken, without delay, to place the matter beyond doubt.

The position of a medical man who, while in attendance on a case of sickness, has his suspicions aroused that poison is being given to his patient, is one of very great difficulty, requiring great discrimination, for on the one hand, he must not delay to take such steps as are necessary for the welfare of the sick person and to safeguard him from the action of the poisoners ; on the other, he must bear in mind that the symptoms exhibited by his patient may be the result of natural disease and that if he makes the statement that he believes the sick person is being poisoned and, on investigation, this is found to be groundless, he will have cast a serious slur on innocent people, for which no subsequent retractation and explanation can make amends ; moreover, he has rendered himself liable to an action for libel.

The most judicious procedure under the circumstances is to carefully watch the case and the conduct of those in attendance. It will generally be possible, by cautious questioning of the patient, to find out whether the anomalous symptoms are connected with the taking of food or drink or medicine, and whether they occur whenever one or other of these articles is taken, or only after administration by a particular person. The practitioner can also obtain, without causing alarm or exciting comment, the urine of the patient and have it examined for the suspected substance. But if the symptoms exhibited by the patient indicate that his life is in danger, the duty of the medical man is to act at once, without waiting to have his suspicions confirmed, he should immediately inform the patient's family, and the patient himself if he is in a condition to bear the disclosure without injury ; it is also advisable to get the friends to inform the police. If from the circumstances, it appears that all or most of the people in the house are concerned in the poisoning, it is better not to say anything to them or to the patient but to communicate directly with the police.

This was the course adopted by a very experienced and judicious medical man in a case which occurred in his practice. He was attending a robust, middle aged man for fever, a day or two before the patient's death, certain anomalous symptoms appeared, which caused him to suspect that his patient was being poisoned, the man's death occurred unexpectedly and rather suddenly. The medical man communicated his suspicions to the police, he suspected that the patient had been poisoned by arsenic, but did not connect the administration of the poison with any particular individual. A police investigation took place and a post-mortem examination was held, at which I attended, at the request of the medical man. No signs of arsenic poisoning were discovered, nor of poisoning by any other substance, the viscera were examined by the Chemical Examiner no poison was found in them, death was undoubtedly due to natural causes.

This case illustrates the difficulty of distinguishing natural disease from poisoning and that a practitioner of great experience may fall into the error of mistaking unusual symptoms of disease for poisoning. The friends were at first extremely indignant at the imputation that had been cast on them, and there was a good deal of general resentment towards the medical man, but in a short time this disappeared and his practice, which had almost ceased in the neighbourhood, was completely restored. The people began to look on the occurrence as an indication of his care and anxiety for the welfare of his patients.

In the diagnosis of poisoning in the living much assistance may be obtained from analysis of the food or other substance, in which it is suspected the poison may have been administered. But it is necessary to bear in mind, in considering the value of the result, that false charges of poisoning have been instituted and in support of them, the individual has feigned the symptoms which he believes the substance produces, and has also introduced some of it into food or drink or medicine. Of greater value is the presence of poison in the vomit and in the urine. Of course it is possible that the substance was put into them after they were voided, but as regards the urine, even if the individual had the knowledge, that poison is eliminated by the kidneys, it is probable that he would put into the urine an excessive quantity which would render the deception evident. Most of the false charges of poisoning break down on investigation, owing to the want of knowledge of the symptoms, and to mistakes in describing the circumstances. More difficult cases to distinguish are those in which some of the poison has been taken. In all cases where a charge of attempted poisoning is brought, the duty of the medical man is to place, before the Court, the medical aspects of the case, to describe the symptoms which he has observed, and the result of the examination of the dejecta, food, and other substances. He will be required to state whether the symptoms could have been caused by the poison discovered in the food or dejecta, or if no analysis was made, or if no poison was discovered, he will be closely examined as to the genuineness and causation of the symptoms. It lies with the Court having heard the evidence of all the witnesses to determine whether the charge is true or false. This does not concern the medical man.

RECOVERY FROM POISONING.

In acute poisoning, the duration of the illness is generally short, the case terminates in death or recovery in one or two days, but the patient is likely to feel the debilitating effects of the illness for sometime after the symptoms caused by the poison have disappeared.

Recovery is brought about by the removal of the poison from the system and the disappearance of the changes in function and structure produced by it. Removal of the poison is effected by different channels.

When a poison is swallowed, its presence in the stomach may induce immediate vomiting, by which a portion or in some instances, the whole quantity, is ejected before it has been absorbed into the system.

The elimination of absorbed poisons is effected by the kidneys, stomach, liver, salivary glands, and skin, and as regards volatile and gaseous substances, by the lungs. The kidneys are generally held to be the most important of the eliminatory channels, but the evidence of recent research goes to prove that the stomach and liver are of equal, if not greater activity, in removing substances from the blood. It has been shown that many poisons which, it was thought, were excreted only by the kidneys, are also present in the fæces in as large and with regard to some substances in larger quantity than in the urine.

Most of the powerful forensic poisons are excreted unchanged, and many of them appear in the urine soon after administration ; with regard to some, elimination begins soon and is completed in a short time ; others, of which arsenic is an important example, quickly appear in the urine, but the elimination is not completed for a long time. Arsenic has been detected, in the urine, half an hour after taking a single dose of five minims of liquor arsenicalis. Von Hofmann mentions experiments on the elimination of arsenic. Three dogs were given daily 0·1 grm. of arsenic for 20, 16, and 26 days respectively, they were killed 39, 28 and 22 days, respectively, after the last dose. In the first dog, which had received the arsenic for 20 days and was killed 39 days after the last dose, arsenic was discovered in the liver only ; in the second dog, dosed for 16 days, killed 28 days after the last dose, the urine showed a faint trace, the brain and bones traces, and in the liver, a larger quantity. In the third dog, dosed for 26 days and killed 22 days after the last dose, there was a much larger quantity in the liver and decided traces in the brain, heart, bones and urine.

Some poisonous substances enter into close combination with the tissues and their elimination is slow and a portion may remain permanently in the body.

Recovery from poisoning by the alkaloids, volatile and gaseous substances, takes place rapidly and, as a rule, is complete, but certain poisons, which have special action on the central nervous system, may produce disturbance of the mind, lasting for a long time. Poisons of the corrosive class, which destroy the tissues they come in contact with, usually produce long continued illness, frequently the recovery is incomplete, and death may result months after the poisoning.

The Evidence of Poisoning in Dead Body.

When required to make a post-mortem examination on the body of a person who, it is suspected, may have died of poisoning, the medical man, if he has not attended the case during life, should endeavour to obtain particulars of the illness, the time of the appearance of the first symptoms, the interval between the taking of food or drink or medicine and their onset, the character of the symptoms, the duration of the illness, and the time of death, the name of the poison suspected, and whether it is supposed to have been administered in a solid form or in solution.

These particulars will be of considerable assistance in making the examination, and especially in coming to a conclusion as to the cause of death. In India, medico-legal post-mortem examinations are almost always made by the Government medical officers in charge of districts, or sub-divisions, or in the large cities by a medical officer, specially deputed for medico-legal work, and when a body is sent for post-mortem examination the police forward a report giving the particulars of the cause of death as far as known. The information is generally meagre, many of the most important particulars are not given, and, not infrequently, the examination proves that the account is incorrect and misleading. This is not generally the fault of the police, their report is based upon the statements of the friends or persons who have seen the deceased during the illness, and the necessity for avoiding delay in having the body examined compels the police to put in the report statements which there has not been time to thoroughly investigate. In this country the people avoid as much as possible being mixed up with a police inquiry, and in a case of suspicious death, great difficulty is experienced in obtaining reliable information. In some instances, the motive is evident, but very often the want of candour and truth in the account of the circumstances gives to a simple case of suicide an appearance of homicide.

The external appearances of the body in cases of poisoning do not, as a rule, give any indications of the cause of death. In poisoning by a few substances, there may be unusual external appearances, for example, poisoning by phosphorus produces an icteric tint of the skin. Carbon monoxide alters the colour of the blood to a cherry red which may be apparent in the conjunctiva and in the death stains. In poisoning by Hydrocyanic acid, the characteristic odour may be apparent before opening the body.

In corrosive poisoning, the lips generally exhibit signs, and there may be streaks on the skin from the mouth to the chin, caused by spilling the poison in the act of drinking ; stains may also be found on the clothes. In poisoning by substances which cause profuse vomiting and purging, the features have a shrunken appearance and the fingers are shrivelled.

But as regards most poisons, the external appearances of the body present no peculiarity by which the cause of death can be diagnosed.

The internal post-mortem appearances in death from poisoning vary ; poisons which corrode or irritate the tissues produce well marked signs, but substances belonging to the neurotic class, in which are included many powerful poisons, cause no visible alteration in the body ; the post-mortem examination reveals the mode of death, generally asphyxia, but not the cause, to discover which the contents of the stomach and the viscera must be examined for the presence of poison.

In making a post-mortem examination, in a case of suspected poisoning, special attention is given to the appearances of the stomach, intestines, and abdominal viscera. When the abdomen has been opened, the external appearances of the stomach and intestines should be noted, the colour of the peritoneum, the presence of fluid in the cavity, the state of the colon, contracted or distended, and the state of the abdominal viscera generally.

The stomach should be tied at both ends and removed unopened. It is advisable to apply two ligatures at each end and cut between them, this will prevent escape of the contents of the intestines and œsophagus. The stomach should be put on a clean dish, not upon the table or any place where it is possible for extraneous matter to adhere to it ; to open it, cut along the lesser curvature. The contents should be first examined, measured, the odour, colour, reaction and general characters noted, also the presence of blood or mucus ; if food is present, its composition and condition as to digestion. When the contents are large in amount, it facilitates thorough inspection to pour them into a large dish, on which they can be spread out in a thin layer and thoroughly examined ; a magnifying glass will be useful ; masses of food, lumps of mucus or blood should be rubbed between the fingers, fine gritty particles will be detected in this way, which would otherwise have escaped notice.

The odour of the contents may be distinctive and indicate the cause of death but not always, for example alcohol, ether, and various medicines may have been administered in treatment.

The contents of the stomach in cases of corrosive and irritant poisoning are generally blood-stained, from erosion of vessels by the action of the poison. In poisoning by substances of the neurotic class, the contents may be coloured red from post-mortem transudation. It is not uncommon in cases of opium poisoning, to find blood, usually in small quantity, in the stomach, apparently due to rupture of small vessels caused by the application of the stomach pump ; hæmorrhages in the mucous membrane may also be caused.

The contents of the stomach having been examined, should be placed in a clean vessel and put aside in a safe place, until the post-mortem has been completed, and it can be decided whether it is necessary to send them and the viscera to the Chemical Examiner.

Attention should next be directed to the state of the stomach ; in poisoning by many substances, the stomach presents a normal appearance, or a slight degree of congestion which is not due to the local action of the poison but to the general venous congestion produced by asphyxia. Some poisons, though belonging to the neurotic class, have local irritant effects, especially when administered in the form of coarse powders. The poisons which produce the most marked signs in the stomach are the corrosives, next to them the irritants.

Corrosive poisons destroy the tissues with which they come in contact, by chemical action which mainly produces a coagulation necrosis, the destroyed tissues being, generally, dissolved and disintegrated by the continued action of the poison. The destruction may extend deeply, and in poisoning by strong mineral acids, particularly sulphuric, the wall of the stomach may be completely destroyed over a considerable area, or even throughout. The intensity of the corrosive effects depends on the substance, its purity, and very largely on the duration of its contact with the tissues. The importance of the last mentioned factor is seen in the comparatively slight action which a corrosive has, when swallowed, on the pharynx and œsophagus, over which it passes with great rapidity.

The colour of the corroded part depends on the poison and its effect on the blood. Some corrosives have a special action on the colouring matter of the blood, sulphuric acid produces Hæmatin, hence vascular tissues destroyed by this corrosive are black or brown ; nitric acid has a special reaction with albumen, and parts destroyed by it are coloured yellow. The colour will be obscured by the presence of much blood, it is particularly well seen in the pharynx and œsophagus.

All corrosives do not soften the parts destroyed by them, carbolic acid hardens.

When a corrosive is diluted it loses its corrosive action, but is still capable of causing acute inflammation. This is seen in the stomach and in the intestines. The corroded areas are surrounded by a zone of intense inflammation which gradually decreases and merges in the healthy mucous membrane. If the patient survives, the disintegrated tissue of the corroded areas is gradually cast off and cicatrization follows. The effect of dilution on the corrosive action is seen also in the intestine ; as a rule, even in cases where the stomach is intensely corroded, the corrosive action ceases at the pylorus, or in the upper part of the small intestine, very often only slight irritation is found beyond the pylorus. The irritative effects produced by a corrosive are not proportionate to its corrosive action ; a strong irritant may have little corrosive power. Arsenic is a powerful irritant and only feebly corrosive.

Irritant poisons cause acute inflammation of the mucous membrane of the stomach, characterised by a deep red colour, swelling, and extravasations of blood, generally small, scattered over the inflamed surface. The inflammation may affect the whole of the stomach, or occur in patches or bands, very often the most marked signs are found on the summit of the folds into which the organ is thrown. The surface of the stomach is covered with a layer of mucus, due to the excessive secretion of the inflamed mucous membrane. On microscopical examination, the capillaries are seen to be engorged, the epithelial cells degenerated, and the mucous membrane infiltrated with inflammatory exudation and blood from rupture of distended capillaries.

Where the inflammation has been most intense and the infiltration greatest, the mucous membrane may perish and be cast off leaving ulcers. Ulceration is not a common result of irritant poisoning; as a rule, in those cases in which an intense gastritis is induced, the patient does not survive sufficiently long for the formation of ulcers. Occasionally small ulcers are found, due to the action of the poison in a solid form on a limited area. In cases of poisoning with coarsely powdered arsenic, if the patient lives for some days, small ulcers will be found around the particles. In the case of a man who took a large lump of arsenic seven days before his death, an ulcer, about two inches in diameter, covered with a slough, was found near the pylorus.

The gastritis caused by irritant poisons does not differ from that produced by natural causes, consequently, to make a diagnosis of poisoning, the symptoms observed during life, the result of the analysis of the contents of the stomach and of the viscera, and the circumstances of the case, must be considered with the post-mortem appearances. The absence of poison in the contents of the stomach and in the viscera does not negative poisoning, the Chemical Examiner may fail to discover poison owing to the patient having survived some time, or to rapid elimination. Fatal cases of acute gastritis from natural causes are rare, and are generally due to unwholesome food, abnormal condition of the gastric secretion, or to bacterial infection.

The effects of corrosive and irritant poisons on the intestines are, as a rule, much slighter than on the stomach. In cases of corrosive poisoning, the duodenum and upper part of the jejunum may be superficially corroded, and lower down, the mucous membrane may be inflamed; occasionally corrosion extends throughout nearly the whole of the small intestine. In a case of poisoning by a strong solution of ammonia, the mucous membrane for a considerable portion of the jejunum was corroded, and lower down and in the ilium there was marked congestion. This case exhibited an unusual feature, the stomach was less affected than the upper part of the intestine. The surface of the stomach was throughout of a deep red colour, swollen, and had a soft, soapy feel. The surface of the upper part of the small intestine was of a brown colour, the epithelium friable, loosened, easily rubbed off; lower down, its condition resembled that of the stomach.

In corrosive poisoning, the mouth, pharynx and œsophagus exhibit signs of the poisoning; generally, the effects, especially in the pharynx and œsophagus, are superficial, owing to the shortness of the period of contact. In the mouth, the signs of destruction are greater, the mucous membrane presents a corroded appearance, and considerable areas are loosened, forming ragged sloughs.

Irritant poisons produce no distinctive changes in the mouth, pharynx and œsophagus.

Before concluding this general description of the post-mortem appearances of poisoning, it is necessary to state that cases of irritant poisoning occur in which no sign of irritation of the stomach or intestines can be discovered, instances of this will be mentioned in connection with poisoning by arsenic.

There are certain conditions of the stomach which may be mistaken for the effects of irritant and corrosive poisons. Redness of the stomach may be due to natural causes. It is sometimes found in death by asphyxia. Another cause of redness is post-mortem staining; this is confined to the dependent portion of the stomach. In India where putrefaction occurs early, it is common to find on the dependent, that is, usually, the posterior wall of the stomach, patches from which the mucous membrane has completely disappeared and the surface is covered with a network of distended vessels. These patches have been mistaken for the result of poisoning; they are easily recognised by the absence of all signs of inflammation and the soft pulpy condition of the mucous membrane around.

Softening of the stomach when unaccompanied by signs of corrosion in the mouth, pharynx and œsophagus, or with signs of vital reaction, is a post-mortem change, due partly to the action of the gastric juice and the acids produced by fermentation of food, and partly to putrefaction. After death, the mucous membrane of the stomach undergoes alterations very rapidly, especially when death occurs during active digestion, the gastric juice attacks and digests the mucous membrane, transforming it into a soft friable mass. In some instances the muscular and serous coats are also digested. As a rule, the self-digestion is most marked in the dependent parts of the stomach, and the disintegration may be complete, resulting in a large perforation. The edges of the perforation, which is irregular in shape, are soft, pulpy, and of a dirty white colour.

Sometimes the edges of the perforation and the softened wall of the stomach are blackened. This is due to transudation of the altered colouring matter of the blood, and occurs only when there has been much blood in the vessels. The following case illustrates the rapidity with which post-mortem softening may occur. In the month of June, a man returned home very drunk, and went to sleep. On the following morning, he complained of pain in the back of the neck. At 10 A.M. he became speechless, and died before he could be removed to Hospital. The post-mortem examination was held about 6½ hours after death. When the abdomen was opened, and the parieties were being reflected from the chest wall, the stomach was accidentally ruptured by slight pressure. The contents were fluid, strongly acid, containing flakes of black substance. The rupture, about two inches in length, had occurred at the cardiac end of the posterior wall ; at this situation, the wall consisted of peritoneum only, the edges of the tear were soft and friable. The surface of the stomach over the whole of the posterior wall was soft and pulpy ; in considerable areas, the mucous and submucous coats were completely disintegrated and the exposed muscle was softened. The colour was of a greyish brown, mottled with black. There was no sign of inflammation, and death was due to natural causes. The viscera and contents of the stomach were chemically examined, no poison was found.

Ulceration of the stomach from natural causes may be mistaken for the result of the action of poison. The appearance of the stomach and the history of the case will enable the distinction to be made. Ulceration from poison is rare and, when present, is accompanied by signs of general, or at least of extensive inflammation of the stomach, and, during life, by symptoms of acute gastritis. The ulcer caused by disease is small, very insidious, as a rule, produces only slight signs of gastric derangement, its shape is conical, base towards the surface, and the surrounding mucous membrane has a normal appearance. The ulcers produced by tumours are accompanied by the changes caused by the presence of the new growth. Perforation due to extension of ulceration caused by an irritant poison is very rare, and would only occur slowly, in the same way that perforation takes place in an ulcer due to natural causes. The perforation produced by corrosive poisons is the result of the direct chemical action of the poison on the tissues, the opening is irregular, ragged, the edges and the wall of the stomach for some distance are softened and disintegrated. Beyond the corroded area, there are signs of irritation and inflammation. The mouth, pharynx and œsophagus are corroded. The corrosive fluid escaping through the perforation attacks the adjoining viscera. The surface of the liver and spleen present a boiled appearance, the peritoneum, corroded in places, is congested throughout if the amount of the corrosive fluid is large. In the small intestine, particularly the duodenum, corrosion and irritation are found.

When a poison is absorbed and enters the general circulation, it has, as a rule, no effect on the blood which acts simply as a carrier and does not itself suffer. There are a few poisons which have a special action on the blood. Carbon monoxide and potassium chlorate have marked effects on the colouring matter. Other substances which are medico-legally unimportant act on the red cells, or on the coagulating property. Antifebrin, phenacetin and other similar substances disintegrate the red cells and convert the hæmoglobin into methæmoglobin.

Poisons of the irritant and corrosive classes, when absorbed, act on the tissues ; they produce granular degeneration, and also, fatty degeneration. These effects are more marked in the subacute and chronic forms of poisoning and are seen in the liver, kidneys, muscles, particularly the heart, and in the vessels. The degeneration appears to be due to the direct action of the poison and its interference with oxidation. It is, in effect, a partial necrosis.

In cases of poisoning, all organs should be examined so that the medical jurist may be in a position to describe their state, notes made, all signs of poisoning and of disease fully described. The post-mortem examination must be complete.

In many poisons, the post-mortem appearances only show the mode of death, and even in those cases of poisoning by substances of the irritant or corrosive classes in which the stomach and intestines exhibit marked changes, the medical jurist is, as a rule, only in a position to state that death was due to a poison of the irritant or of the corrosive class. He cannot, without obtaining a chemical examination of the viscera, specify the particular substance, at all events, not with the certainty which is requisite in a medico-legal opinion. During the post-mortem examination, he should set aside portions of the viscera. It will, as a rule, be sufficient to retain the stomach and its contents, portion of the liver and one kidney, but if there is any suspicion of the case being one of homicide, it is advisable to remove the upper part, or the whole of the small intestine with its contents. It should be opened, after removal, on a clean dish, and its appearances and contents carefully examined. The whole of the liver, both kidneys, the bladder and its contents, may also be sent to the Chemical Examiner. The object of retaining so much of the viscera is to ensure that the Chemical Examiner may have sufficient to obtain a fatal dose of the poison. Every medical man is, of course, aware that the quantity of poison found in the body, does not represent the quantity administered, especially when the patient has vomited and purged freely. Even where there has been no vomiting and purging, most poisons are quickly eliminated by the urine, but, as I have experienced, if the Chemical Examiner has not been able to separate, from the portions of viscera submitted to him, a poisonous dose, lawyers are likely to look on it as damaging the case for the prosecution. In India, in cases of homicide by poisoning, large quantities of poison are, as a rule, administered, and by sending the viscera mentioned, the Chemical Examiner will find no difficulty in separating a fatal dose.

Having determined on the viscera to be sent to the Chemical Examiner, a sufficient number of clean jars is to be obtained. The medical jurist should himself examine the jars to ensure their cleanliness. Into one jar the stomach and its contents should be put, into another the portion of liver and one kidney, or, if the case is one of suspected homicide, the liver should be placed in one jar, the kidneys in another, and the small intestine and its contents in another. In this country, it is necessary to add a preservative, pure spirit should be used and a sufficient quantity added to each jar. If the poison suspected is alcohol, a saturated solution of salt should be employed as a preservative. Having added the preservative, each jar should be corked, the mouth covered over with wax-cloth tied on securely, and the string carefully sealed. Every precaution must be taken to guard against tampering with the jars; the seal should be the private seal of the medical man, not an office seal. On the wax-cloth, the name of the deceased, the portion of viscera in the jar, should be clearly written, and the date. A specimen of the preservative used, in a clean bottle, sealed and labelled, should be sent with the viscera to the Chemical Examiner.

The orders of Government regarding the forwarding of articles for analysis in cases of suspected poisoning should be strictly adhered to.

The result of the chemical analysis may be positive or negative. The former is of greater value, but though a poison be detected death may be due to other causes. The result of the chemical analysis must be considered with the post-mortem appearances and the symptoms observed during life. The poison found may have been introduced as a medicine, or it may be due to the habits of the individual. Thus, in India, opium may be discovered in the viscera due to the deceased having been an opium-eater. It is manifest that, before declaring that the poison found in the viscera was the cause of death, the quantity of the poison, the symptoms during life, and the state of the organs must be considered. If these factors corroborate each other the medical jurist may confidently state that death was due to the poison.

The objection may be made that the poison was introduced into the viscera after death; to avoid this, the greatest care should be taken to ensure cleanliness and to guard against accidental or intentional contamination.

When the analysis results in the discovery of only a trace of poison, the case may yet be one of death from poison. As before mentioned, the elimination of some poisons is rapid and complete, others remain for a longer time in the body, but if an individual survives acute poisoning for two or three days, and, especially, if there has been free vomiting and purging, it is probable that no poison or only a trace will be found in the viscera.

When a case of poisoning is under observation during life, care should be taken to preserve the dejecta, vomit, urine and fæces, for chemical analysis, the assistance which an analysis of these substances affords in the diagnosis of poisoning, has been mentioned. It also proves of great value in determining the cause of death. In many cases of poisoning though the viscera contain no poison, a large quantity is found in the vomit, or in the washings of the stomach.

Should the chemical analysis of the viscera give a negative result, poisoning is not excluded, for, as already stated, the poison may have been completely eliminated, or it may have undergone changes in the body, or it may be a substance for which no certain tests exist. A negative result may be due to an insufficient quantity of the viscera having been submitted to analysis, or to certain organs and tissues not having been analysed. In chronic poisoning by certain substances, the distribution of the poison in the body is unequal, and unless a sufficient quantity of the tissues or organs in which the poison is deposited be examined, the analysis gives a negative result.

For cases where a poison is not found in the body, and yet the circumstances point to poisoning, it has been recommended to test the effects of extracts of the contents of the stomach and of other parts of the body on animals. These tests are of use but should only be employed when, by chemical means, a substance has been obtained, which is clearly not a normal constituent of the body, and for which no chemical tests are known. Its qualities may be determined by noting its effects on animals. For many of the well known vegetable alkaloids there are no decisive chemical tests and for their identification recourse must be had to experiments on animals.

When a substance is obtained from the viscera in a case of suspected poisoning and, for its identification, it is necessary to employ the physiological tests, great care must be taken in arriving at a conclusion. It is well known that animals exhibit very different degrees of susceptibility to the action of poisons, and that the symptoms produced by a poison may vary according to the animal experimented on. It has been shown, by many observers, that decomposing and even fresh bodies contain substances of an alkaloidal character which can be separated from the animal tissue by the chemical means employed for separating vegetable alkaloids, and that some of these substances, in their chemical reactions, closely resemble vegetable alkaloids. They are called Ptomaines. A large number of Ptomaines have been discovered, most of them are non-poisonous, and, of those possessing actively poisonous qualities, the most important, neurin and mydalein, are not produced in appreciable quantities until a considerable time after death. Later researches into the properties of Ptomaines show that although they may, in certain reactions, simulate vegetable alkaloids, the similarity does not extend to all the chemical and physiological tests, and that a competent observer can always distinguish the alkaloids of cadaveric from those of vegetable origin.

CHAPTER XVII.

CORROSIVE POISONS.

These are substances which, by chemical action, corrode and destroy the tissues. In order to produce its most marked corrosive action, the poison must come in contact with the tissues in a pure state; the extent of the destruction depends on the quantity of the poison.

The corrosive action is diminished by dilution, and a poison which in the pure state is a powerful destroyer of the tissues, when diluted, acts as an irritant; further diluted, has only a stimulating effect, and in still weaker form, has no appreciable local action. The destructive effect also varies with the tissue acted on. A delicate tissue is more extensively and deeply corroded by a given quantity of the poison than a tougher, more resistant structure.

Although the corrosive action disappears when the poison is sufficiently diluted, yet on absorption into the system, changes are produced, which, in the case of the mineral acids, are of a marked character. The absorbed poison, though so diluted that it causes no apparent change in the blood, the reaction of which is not altered, and which serves as a carrier only, produces cloudy swelling, granular, and even fatty degeneration of the cells of organs, particularly of the liver and kidneys, and of muscle fibres, especially those of the heart. The following case illustrates the secondary effects of poisoning by sulphuric acid. The deceased, a young woman, died on the third day after taking sulphuric acid. On post-mortem examination, the muscle of the heart was of a pale yellow colour, abnormally soft and friable, the liver had a marked greasy appearance, the kidneys also presented a greasy appearance. There were no signs of corrosion in the mouth and throat, the mucous membrane of the lower part of the œsophagus and of the stomach was superficially corroded. In the stomach, the corrosive effects were confined to the neighbourhood of the pylorus, where there were extensive patches and streaks of corrosion involving only the mucous membrane.

The symptoms caused by swallowing a quantity of pure or nearly pure corrosive do not materially differ, and the following account may be taken as applying to poisoning by a mineral acid, or by a caustic alkali. Later, under each of the more important corrosives, mention will be made of special symptoms.

The onset is immediate, there is no interval; as soon as the corrosive is taken into the mouth, a burning pain is felt, which extends to the throat, œsophagus, and stomach as the poison reaches these parts. Its entrance into the stomach is usually followed by immediate vomiting, the contents of the stomach are ejected, and being mixed with the poison, if an acid, effervesce if they fall on a floor containing carbonates. The vomited matter contains blood, much mucus, and often fragments of mucous membrane, dislodged from the corroded surface of the stomach, œsophagus, or mouth. Vomiting is violent while it lasts, which in my experience is for only a short time, though it may be followed by retching, without the ejection of any matter from the stomach.

In some cases there is no vomiting. These are cases in which the quantity of powerful corrosive has been large, the stomach is at once deeply corroded and consequently unable to expel its contents.

When the mouth is involved in the corrosion, which does not occur in all cases, owing to the poison having been poured into the back of the throat, there is a constant flow of mucus and saliva, mixed with blood and shreds of the corroded mucous membrane. The voice, husky and low, may be completely lost, articulation and any movement of the jaws cause pain. The lips may be corroded, and streaks may be observed on the skin of the face from the angles of the mouth. Marks of the poison may be observed on the fingers and on the clothes.

In most cases within a short time after the poison is taken, the patient passes into a condition of collapse, his face is pinched, expression anxious, skin cold and clammy, pulse very weak, or imperceptible at the wrist, breathing shallow and respiratory movements feeble. The breathing may be especially affected, owing to involvement of the larynx. Sudden death has occurred from spasm of the glottis due to the entrance of the corrosive fluid.

The mind remains clear. The abdomen is distended, there is no diarrhœa, urine is suppressed.

The collapse increases and in most cases, death occurs in less than 24 hours. As already mentioned, death may occur within a few minutes from spasm of the larynx, or from shock. The patient may remain in a state of semi-collapse for days and die of exhaustion and the effects of the absorbed poison, or reaction may occur and death may be caused by inflammation, or sepsis due to absorption of matter from the sloughs.

If the patient survives the period of repair, he may die from stricture, the result of cicatrization, or from inanition due to the destruction of the mucous membrane of the stomach.

An individual, who has swallowed a powerful corrosive poison, may die from the changes produced, months or even years, after the poison was taken.

The prognosis in corrosive poisoning is always bad, the dangers, immediate and remote, are so numerous that few individuals recover, very few regain their normal health after poisoning by strong mineral acids or caustic alkalies.

Post-Mortem Appearances.

These depend on the quantity and strength of the poison. Corrosion of the mouth, throat, œsophagus, and stomach, varying in extent and depth, is found. Not infrequently, complete destruction of the walls of the stomach over a considerable area occurs, with escape of the contents into the peritoneal cavity, and corrosion of the peritoneum and abdominal organs; an example of the extreme effects of a powerful corrosive will be given in the description of poisoning by sulphuric acid.

Beyond the corroded areas, the tissues exhibit signs of inflammation, the result of the poison having reached them in a diluted condition. If the patient survived some days, signs of the separation of the dead tissues and of repair will be found. If death occurred a considerable time after the poisoning, the corroded areas will be indicated by cicatricial tissue.

Treatment.

The stomach-pump must not be used, nor emetics. The treatment should be directed towards neutralising the poison by the administration of appropriate substances; if an acid has been taken, alkalies should be given; if the poison is a caustic alkali, weak acids, preferably of vegetable origin.

As in the treatment of all forms of poisoning, but even of greater importance in the case of a corrosive, prompt administration is more valuable than the selection of a particular remedy. The medical man should give the remedy nearest at hand. If an acid has been taken, scrapings of lime from the wall, or soapy water, or any alkaline fluid immediately obtainable is of vastly more benefit than the remedy which has to be sent for to the chemist. It rarely happens that the medical man sees the patient until the destructive energy of the corrosive has expended itself, nevertheless he should administer neutralising agents, so as to prevent the absorption of the diluted poison into the system, and to guard against the degenerative effects, which the introduction of a large quantity, though no longer of a strength to corrode, produces on the heart, liver, and kidneys.

The next indication is to alleviate pain by opiates, which are best given in the form of hypodermic injections of morphine, or by the bowels. The patient's strength should be kept up, it is better not to give anything by the mouth. Generally the patient cannot swallow, the attempt causes pain, and even if successful, vomiting will probably follow, moreover, the stomach is not in a condition to digest. Nutrient enemata should be given. If the patient survives, treatment will be directed to supporting his strength and to checking the inflammation, which attends the separation of the sloughs. Into this it is not necessary to enter.

SULPHURIC ACID, OR OIL OF VITRIOL.

The commercial uses of sulphuric acid are numerous, and it is also not infrequently kept in private houses for cleaning metal utensils and ornaments; under these circumstances, it is not surprising that accidents occur, especially as the people of India are extremely careless in the matter of the safe-keeping of dangerous substances.

Sulphuric acid is a typical corrosive of the most powerful description. When a large quantity of the strong acid is taken, the patient falls into a condition of collapse within a very short time, and death takes place in a few hours. In cases of this kind, vomiting does not occur, or, at most, the stomach acts once. Pain, after a few minutes, is not complained of, the patient lies collapsed, and dies within a few hours. The following case exhibits, in a typical manner, the effects of a large dose of strong commercial sulphuric acid. The deceased, a prostitute, had been suffering from fever for some days, and had been given some medicine by a quack. She sent him a message that the medicine had purged her, and she would take no more of it. He gave the messenger a bottle, with instructions to administer a chittack, about two ounces, to the patient. This was done about 9 A. M. The woman immediately complained of intense burning pain, and in a few minutes became so low that her friends removed her to Hospital where she died at 2-30 P. M., about 5½ hours after taking the poison.

On post-mortem examination, the lips were blackened and charred. The mouth was charred, the tongue, to the depth of an eighth of an inch, was of a dead white colour. The mucous membrane of the mouth was softened and loosened. The pharynx and œsophagus were corroded through the whole depth of the mucous membrane for their entire extent, the surface was of a greyish white colour.

On opening the abdomen, 40 ounces of fluid were found in the peritoneal cavity. The fluid was of a dark colour and contained masses and flocculi of black material, apparently altered blood and tissue. The surface of the peritoneum, over nearly its whole extent, was charred of a dead white colour ; the liver and spleen were corroded and presented a cooked appearance to the depth, in places, of a quarter of an inch ; portions of intestines, especially of the transverse colon, were blackened and charred. The stomach was represented by a black mass, ragged, softened. The whole of the body of the organ was completely destroyed, there remained only a portion about the œsophagus and about the pylorus. These were connected along the lesser curvature by a narrow strip of tissue. In the duodenum, the corrosion was marked in the upper part, and diminished rapidly lower down, but for three or four feet of the jejunum, the mucous membrane was superficially corroded.

In Hospital, the woman was completely collapsed, and unconscious for about three hours before death. The surprising feature of the case is that the patient survived so long ; with such extensive destruction of important organs immediate death would be expected. There is no mention of vomiting in the history; in another case in which I made particular inquiry, no vomiting occurred. The deceased had been drunk the previous night, and in the morning by mistake drank from a bottle of sulphuric acid used in his trade of goldsmith. He immediately informed his friends who removed him to Hospital where he died in about 12 hours. No vomiting took place, the stomach was completely corroded down to the peritoneum. On opening the abdomen, the stomach presented a dark red appearance, and along the lesser curvature there was an extravasation of blood beneath the peritoneum.

The surface of the liver adjoining the stomach was acutely congested.

The contents of the stomach were about four ounces of dark red fluid with masses of coagulated blood and mucus.

The tongue and inside of the mouth were of an ash-grey colour, the surface of the œsophagus was shrivelled, of a dirty white colour, and corroded throughout.

The stomach was rough, swollen, corrugated, and of a dark red colour. The corrosion extended down to the peritoneum; along the lesser curvature the alteration was much less, probably owing to the fact that the man was standing when he drank the acid. In the duodenum, the changes were similar to those in the stomach, but penetrated less deeply; in the jejunum, the mucous membrane was superficially corroded for three or four feet. Lower down there were scattered patches of acute congestion, the ilium was normal. There was a quantity of bloody fluid in the small intestine.

Action of Sulphuric Acid.

When brought into contact with animal tissue, strong sulphuric acid removes the water and chars the solid matter, albumen is coagulated and subsequently redissolved, the blood is also coagulated and its colouring matter is changed into acid hæmatin. If the tissue contains much blood and fluid, the result of the action of the acid is the production of a dark, or black, slimy mass. Tissues containing less fluid are charred and present a dark red, cooked appearance.

Perforation of the stomach occurs in about one-third of the cases. The edges of the perforation are soft, slimy, ragged, of a dark or black colour; the surrounding wall is corroded, farther away acutely inflamed.

Fatal Dose.—An adult has been killed by one drachm of sulphuric acid; it is evident that a much smaller quantity might prove fatal by causing spasm of the larynx.

Recovery is said to have occurred after a dose of three ounces.

The Prognosis is bad, most of the cases die within twenty-four hours. Death may occur later from septic inflammation, during the separation of the sloughs or from exhaustion; or still later from the consequences of destruction of the mucous membrane of the stomach, or from stricture of the œsophagus or stomach. The dangers, immediate and remote, are so numerous that the chances of recovery are very poor, and complete restoration to health is quite exceptional.

The treatment has been described.

Nitric Acid, Aqua Fortis, or Fuming Spirits of Nitre.

Nitric acid is much used for various commercial purposes, and judging from the cases of poisoning, which have come before me, it is not infrequently kept in private houses, probably for cleaning metallic articles. The symptoms produced by a poisonous dose of strong nitric acid have been sufficiently described in the general account of corrosives.

The following case may be taken as typical of poisoning by this acid:—The deceased quarrelled with her husband, and shut herself up in a room with her young son, she took a bottle from a shelf and drank the contents; the son raised an alarm, the door was opened. The deceased was found lying on the floor in a semi-unconscious condition. She was removed to Hospital where she stated that she had taken nitric acid. Death occurred about twelve hours from the taking of the poison.

On post-mortem examination, there was a yellow mark of the acid on the left index finger, the lips were yellow. The interior of the mouth, pharynx, and the whole length of the œsophagus, were corroded and yellow. The abdomen was full of fluid, the peritoneum was congested. The stomach was corroded and perforated, the opening was near the great curvature and was large with ragged margins. The coats of the stomach were thickened and of a dark red colour. There was corrosion of the duodenum, and of the upper part of the jejunum.

Perforation of the stomach is less common than in poisoning by sulphuric acid, it occurred in two of the cases examined by me at the morgue.

In another suicidal case, the deceased drank the acid out of a brass cup; the corroded surface of the mouth and œsophagus were of a greenish grey colour. In this case, the whole length of the small intestine exhibited signs of corrosion. From the condition of the bed on which the deceased was found dead, it was evident that he had several evacuations, the motions were of a greenish colour.

The effect of nitric acid on the tissues is to coagulate the albumen; strong acid causes a further change by producing a yellow substance, xantho-proteic acid, which gives the characteristic yellow colour to the marks of the acid on the skin and mucous surfaces. In none of my cases was the surface of the stomach yellow, probably the quantity of blood present obscured the reaction.

Fatal dose.—Two drachms caused the death of a child, aged 13 years, this is the smallest fatal dose on record.

Death may occur immediately from involvement of the larynx, in most cases it takes place within 24 hours. In a case, examined in 1900, the deceased, a woman, lived for 36 hours, the stomach was deeply corroded, there was no perforation, but in several places the wall was completely softened down to the peritoneum.

Prognosis is bad, hardly less so than in poisoning by sulphuric acid.

Treatment is the same as for sulphuric acid.

Hydrochloric Acid.

In Calcutta poisoning by this acid is very rare, only one case came before the police surgeon, during eight years. The following is an account of it:—The deceased, a young man, had been suffering from pain in the stomach (probably dyspepsia), some one advised him to get acid, mix it with water and drink it. This he did, and, on returning home, told his father, at the same time complained of severe burning pain in the stomach. His condition alarmed the father who removed him to hospital where he died the same night. The post-mortem examination was held 9 hours after death. The surface of the lower lip was yellowish white, and softened. The tongue was yellow, the mucous membrane of the pharynx and œsophagus was corroded and of a yellow colour. On opening the abdomen, the peritoneal coat of the stomach was reddened, acutely congested, and there was œdema of the tissues along the lesser curvature. The stomach contained two ounces of dark fluid, apparently altered blood and mucus, the whole of the surface was black and corroded.

The larynx, trachea, and bronchi were acutely inflamed ; there was much secretion in the bronchi, the lungs were very congested.

The case illustrates the effect of hydrochloric acid on the larynx and respiratory tract.

It is most probable that the acid taken, in this case, was the ordinary commercial acid which usually contains free chlorine and other impurities, but even pure hydrochloric acid acts as a powerful irritant to the larynx.

Hydrochloric acid does not stain the skin ; its corrosive effects are described in the case quoted. Perforation of the stomach is rare.

Fatal dose, four drachms.

Treatment as in poisoning by sulphuric acid ; the laryngeal symptoms may necessitate tracheotomy.

MEDICO-LEGAL ASPECT OF POISONING BY MINERAL ACIDS.

Poisoning by the acids above described is, as a rule, either accidental or suicidal. In none of the cases which I have seen, was there any suspicion of homicide. Some of the cases said to have been accidental, were probably suicidal. Murder by these acids is very rare, the victims have been mostly children, or helpless persons.

Sulphuric acid has been injected into the vagina to procure abortion, and there are, on record, cases where, by mistake, it has been injected into the rectum as an enema. Von Hofmann met with a case of this description which was possibly homicidal.

CORROSIVE ALKALIES.

The principal poisonous alkalies are potash, soda, and ammonia, and their carbonates.

The effects of a poisonous dose are immediate burning pain from the mouth to the stomach, vomiting, the vomit containing much mucus, blood and shreds of mucous membrane. When the dose is large, the patient quickly falls into a state of collapse, and death occurs within 24 hours. In some cases, purging has been observed, the stools containing blood and mucus.

THE POST-MORTEM APPEARANCES vary according to the quantity and strength of the poison, the destruction of the mucous membrane of the mouth, throat and œsophagus may be very marked. In some cases, the walls of the stomach were corroded throughout, and of a black colour from altered blood.

Only one case of poisoning by an alkali has been examined in the Calcutta morgue during a period of eight years. The case is interesting, and may be briefly described. The deceased, a man, aged about 22 years, was discovered lying on the floor of his room, about 2 A.M.; near him, there was a box of photographic chemicals and a broken bottle labelled Liq. Fort. Ammon. He stated that he had drunk some acid and requested that a medical man should be sent for. To the medical men who came, he made the same statement, and pointed out the broken bottle as the one from which he had drunk. He was removed to Hospital, and died about noon.

The post-mortem examination was held on the following morning. The inner surface of the lips was roughened, the tongue was denuded of epithelium, the interior of the mouth was corroded, the surface of the pharynx and œsophagus was corroded, and of a red colour. The epiglottis and the aryteno-epiglottic folds were congested and swollen.

The under surface of the liver, in contact with the stomach, was of a deep red colour and corroded to the depth of an eighth of an inch.

The stomach contained about 16 ounces of bloody fluid, the whole of the surface was of a deep red colour, the mucous membrane was swollen, and, to the touch, had a soft, soapy feel. The stomach was thrown into folds. In the small intestine, the mucous membrane was of a brown colour, friable, loosened, easily rubbed off, this condition extended a considerable way down the jejunum ; lower down, and in the ilium there was marked congestion. The large intestine was not affected.

The quantity of the poison taken was said to be about an ounce and a half. It will be noticed that the patient was conscious for a considerable time after taking the poison, and that there was no dyspnœa.

Fatal doses.—40 grains of caustic potash have killed, probably the same quantity of caustic soda might prove fatal, two drachms of liquor ammoniæ fortis (B. P.) have caused death.

The fatal result generally takes place within one or two days ; or, the patient may die long after the poison was taken from exhaustion, or from starvation, owing to the destruction of important tissues ; death may be very rapid from involvement of the larynx.

Poisoning by the corrosive alkalies is generally accidental or suicidal. Von Hofmann met with two cases of murder of children, by their mothers who gave them caustic lye, and then committed suicide by the same means.

Carbolic Acid.

Owing to the extensive use of carbolic acid as a disinfectant and in medicine, cases of poisoning by it are not uncommon. They are generally accidental or suicidal, the strong well known odour of this acid prevents its use for homicide.

Carbolic acid is a corrosive and also a narcotic, the symptoms partake of both qualities. When a large quantity of the acid is swallowed, a burning pain is at once felt from the mouth to the stomach, vomiting may occur, but is generally absent, and the patient becomes insensible within a few minutes, convulsions may be observed. The insensibility deepens into coma, the breathing is stertorous, death takes place within a short time. In one of the recorded cases, it occurred in ten minutes. In a case seen by me a few minutes after the poison was taken, the patient was comatose, breathing stertorous, jaws tightly closed, could not be opened, the body was rigid, death occurred in an hour. The deceased was a compounder in the Medical College Hospital, and was engaged at his duties ; he was noticed drinking a dark fluid out of a measure glass, and immediately after fell down unconscious and convulsed. He took about an ounce and a half of pure carbolic acid.

Post-mortem Appearances.

The lips and interior of the mouth are whitened, due to corrosion of the epithelium, which is white, friable and easily detached. The surface of pharynx and œsophagus is similarly affected. In stomach, the mucous membrane is generally in folds, the surface white from corrosion of the epithelium, patches of which may be detached, exposing the bright red, inflamed mucous membrane. The corrosive effects may extend through the entire wall of the stomach, but as a rule, are confined to the mucous coat.

The odour of carbolic acid may be apparent, not only in the stomach and intestines, but throughout the body, in the lungs, brain, kidneys, and in the urine.

The following is a brief account of one of the cases examined at the morgue:—The deceased, a young woman, had a quarrel with her husband, and, while standing in the verandah, was seen to drink from a bottle containing carbolic acid. She was immediately given lime water, soda, and cocoanut oil, and removed to Hospital where on arrival she was found to be dead. On post-mortem examination, no corrosion was seen in the mouth and throat, the lower part of the œsophagus was congested. The stomach contained six ounces of reddish fluid, with masses of whitened epithelium and mucus; the surface of the stomach was acutely inflamed and covered with white corroded epithelium, which had been detached in places, exposing the red inflamed mucous membrane; the duodenum was congested, and in the jejunum there were patches of congestion in the upper part. Except in the stomach, the odour of carbolic acid was not apparent in the body. The lungs were very congested, the bronchi filled with frothy mucus, which was also present in the trachea and about the nostrils, the general appearances were those of the asphyxial mode of death.

A European, the steward of a ship, committed suicide with carbolic acid and laudanum. He was discovered within a few minutes of taking the poisons, unconscious, and died in about an hour. The lips, mouth, throat, œsophagus, and stomach were white from corrosion of the epithelium. The peritoneal coat, at the cardiac end of the stomach, was acutely congested, the coats of the stomach were corroded throughout. The contents of the stomach had the odour of carbolic acid and of opium.

FATAL DOSE—One drachm has proved fatal, recovery has followed large quantities, 3 or 4 ounces.

Death usually occurs within a few hours. The injection into the rectum of a large quantity of carbolic acid caused death. Poisoning may result from the application of carbolic acid to a sore.

Treatment.—Magnesia, oil, albumen, milk, should be administered freely.

CORROSIVE SUBLIMATE.

Corrosive sublimate, perchloride of mercury, or mercuric chloride is a very powerful poison ; in large doses, it produces the symptoms of acute corrosive poisoning ; in smaller, but still poisonous quantity, the symptoms are of a less acute character, resembling the effects of poisons of the irritant class.

IN ACUTE CORROSIVE SUBLIMATE POISONING, the ontset is immediate ; as soon as the poison is taken, the patient experiences a metallic taste, and burning pain in the mouth, throat and stomach, vomiting occurs at once, the vomit being blood stained, and containing masses of white matter, coagulated albumen. The mucous membrane of the mouth and throat are corroded and of a greyish white colour. The pain and vomiting are quickly followed by collapse, and death occurs within twenty-four hours. In some of the recorded cases, death took place in four hours, and in one case, in half an hour.

THE POST-MORTEM APPEARANCES—The surface of the mouth, throat and œsophagus is corroded, of a greyish white colour. The stomach may be corroded through the entire thickness of its walls, the peritoneum presenting a greyish white colour ; this condition is, as a rule, confined to the posterior surface. The contents of the stomach are masses of coagulated albumen and mucus mixed with bloody fluid. The mucous membrane is thrown into folds, rigid, thickened, and the surface of a greyish colour. The changes are due to the coagulating and hardening property of the poison, the tissues are fixed and hardened.

The corrosive appearances may extend into the duodenum, and jejunum, for a short distance.

In The Sub-Acute Form of Poisoning, the symptoms are a metallic taste and burning pain in the mouth and down to the stomach. Vomiting of masses of white coagulated albumen, later, there may be much blood in the vomit. There is diarrhœa with blood and mucus in the stools ; swelling of the abdomen and great pain increased by pressure, intense thirst ; the general symptoms are cold, clammy skin, weak small pulse, feeble respiration. The symptoms continue and the patient dies of exhaustion in four or five days. Salivation may appear on the second or third day, but is more often absent. The urine is albuminous and often suppressed. On post-mortem examination, the mucous membrane of the pharynx and œsophagus is congested, the epithelium shed, or if adhering, loosened, and easily detached.

The stomach contains bloody fluid mixed with bile and mucus ; its surface is inflamed, swollen, and œdematous ; the epithelium, corroded, detached, laying bare the inflamed surface ; in the walls of the stomach, extravasations of blood.

In the lower portion of the small intestine, the mucous membrane is inflamed and swollen ; in the colon, dysenteric ulcers, covered with sloughs, are frequently found.

The liver and kidneys are very congested.

The following case of corrosive sublimate poisoning is interesting and illustrates the local corrosive action of the poison:—The deceased, a durwan, went up to a native police officer on duty in Chowringhee Road, and stated that a man, a stranger, with whom he had walked back from Kalighat, had, on parting at the corner of Chowringhee, given him a pân. He put it into his mouth, and began to chew it ; in a few minutes he felt a burning pain in his month, and a sensation of swelling of the tongue and throat. He was taken to hospital, and, on examination, his mouth and throat were found to be corroded ; there was dyspnœa, tracheotomy was performed. He died on the 5th day. On post-mortem examination, the interior of the mouth, the pharynx, and œsophagus, were found to be corroded, covered with wash leather sloughs, the gums were also corroded, the front of the tongue was denuded of epithelium, the epiglottis was swollen, rigid, and covered with slough, the aryteno-epiglottic folds were very swollen.

The stomach contained curdled milk and bile, its mucous membrane presented patches of congestion, distributed all over the surface. In the transverse colon, there were small areas of acute congestion. There was congestion of the liver, and marked congestion of the kidneys ; pneumonia in the stage of consolidation of the whole of the lower lobe of the left lung.

On chemical analysis, mercury was found in the liver and kidneys, not in the stomach, tongue, œsophagus and larynx, nor in the contents of the stomach.

The circumstances of the case are peculiar. There is no reason to think that deceased made a false statement and intentionally took corrosive sublimate, nor is it at all probable that the stranger, a casual companion, had any idea of the poisonous nature of the pân. It is difficult to account for the presence of the poison, possibly the lime used in the pân contained it. Having regard to the careless way poisons are kept in native shops, this seems not unlikely. There is another possible explanation, the corrosive sublimate may have been added to the pân, in mistake for cocaine hydrochloride. Of late the custom has arisen of putting cocaine in pân, which is sold at a higher price by pânwallahs.

Fatal dose of corrosive sublimate, 3 grains have killed. Fatal poisoning may be caused by absorption of the poison through wounds or ulcers. Uterine injections of corrosive sublimate solution 1—2,000 have caused death.

Poisoning by corrosive sublimate is generally either accidental or suicidal, rarely homicidal.

Several salts of mercury are corrosive poisons, red precipitate, white precipitate, and the nitrates of mercury produce symptoms and post-mortem appearances similar to those of corrosive sublimate. They are of little medico-legal interest and need not be further referred to.

Oxalic Acid.

This substance is used in various trades, yet in India poisoning by it is rarely met with ; in Europe, most of the deaths are accidental, some are suicidal; its sour acid taste prevents its use in homicide. Many accidental deaths have occurred from mistaking oxalic acid for Epsom salt, to which it bears some resemblance, though the taste is quite different. Epsom salt is bitter, oxalic acid has a sour acid taste.

SYMPTOMS.—When taken in concentrated form the symptoms begin immediately, there is burning pain in the mouth, throat, œsophagus, and stomach, vomiting occurs at once, the vomit is generally bloody, purging may follow. The patient quickly falls into a condition of collapse, and death occurs within a short time.

If the acid is diluted, or if the stomach is full of food, the corrosive symptoms are less marked, and the effects of the poison on the central nervous system are seen, convulsions, tetanic spasms, occur, during which death may be caused by asphyxia ; after a time, the patient falls into a comatose condition.

If the poison is in a state of still greater dilution, the symptoms of corrosion or of irritation, may be altogether absent, and only those of a narcotic may occur.

THE FATAL DOSE—One drachm killed a boy in 21 hours, half an ounce may be considered the fatal dose for an adult.

THE POST-MORTEM APPEARANCES.

When concentrated acid has been used the corrosive effects on the mouth, throat, œsophagus, and stomach are marked, the surface of the mucous membrane is corroded, white in colour, and loosened ; in the stomach, the corrosive effects may extend through the entire wall.

More diluted acid produces irritation of the mucous membrane. In those cases where the symptoms are purely narcotic, no local effects may be observed.

TREATMENT.—Neutralization of the acid by chalk, magnesia suspended in milk or mucilage ; much fluid should not be given, as it aids the absorption and diffusion of the poison. Alkaline carbonates should be avoided, as the oxalates of the alkalies are as poisonous as oxalic acid. Scrapings of the wall will generally prove the readiest, and therefore the best antidote.

The general treatment should be on the lines laid down previously.

Poisons of the Irritant Class.

An irritant is a poison which causes irritation and inflammation; the mode of action of irritant poisons has been described in the chapter dealing with the evidence of poisoning in the dead body. The inflammation produced by an irritant poison does not differ from inflammation caused by other means, and is characterised by redness, swelling, heat, and pain, with alteration or disturbance of function. The intensity of the inflammatory process depends on various factors, the principal of which are :—The poison, different poisons of the irritant class produce different degrees of inflammation ; the quantity of the poison ; the susceptibility of the tissues, and of the individual. A pure irritant does not cause corrosion of the tissues, but death of the inflamed part may follow, owing to the intensity of the inflammatory process ; the surface may undergo molecular disintegration, producing ulcers, or the vitality of a portion may be destroyed, forming a slough. Some irritants have corrosive properties though these are feeble in comparison to the irritant action.

When an irritant, in poisonous quantity, is introduced into the body, the resulting inflammation is generally confined to the mucous membrane of the stomach and intestines, principally the former, and this effect is produced by whatever channel the poison has been introduced ; for example, arsenic applied to an ulcer, if absorbed, causes gastro-intestinal irritation, and the stomach exhibits the signs of inflammation, similar to those produced by a quantity of the poison in solution, equal to that absorbed from the ulcer, administered by the mouth. The mucous membrane of the stomach, and, to a considerably less extent, that of the intestine, exhibits a special susceptibility to arsenic, and, it may be added, to other poisons of the irritant class.

Symptoms of Irritant Poisoning.—When an irritant poison is taken into the stomach, as a rule, an interval occurs, during which there are no symptoms. The symptoms begin with nausea, followed by vomiting, and purging ; the vomit, after the contents of the stomach have been ejected, is bilious fluid, frequently blood stained, the stools are watery, may be of a rice-water character, or bilious and bloody. There is pain in the stomach and abdomen, of increasing severity, cramps in the limbs, the purging is attended by tenesmus, there is great thirst. After a time, depending on the strength of the patient and the violence of the symptoms, collapse sets in, the pulse becomes weak, and later imperceptible, the breathing feeble, the voice hollow, the surface of the body is cold and clammy, the fingers wrinkled, the features pinched, urine suppressed, there is great restlessness and anxiety, the mind is usually clear up to a short time of death ; in some cases, the patient sinks into a comatose condition for some hours before death. The duration of the case is subject to wide variations, death generally happens in from one to four days, but as will be illustrated later, may happen within a few hours, or even in less time.

The above general account of the symptoms of irritant poisoning applies to most of the poisons of this class. Many of the irritant poisons have little medico-legal importance, some are of considerable interest and one, arsenic, is for the medical jurist in India, the poison of greatest importance, he meets with cases of accidental, of suicidal, and, of homicidal poisoning, by arsenic ; it is the poison most frequently used for murder ; the consideration of the symptoms, post-mortem appearances and circumstances of poisoning, by it, will therefore be detailed.

Before dealing with arsenic poisoning, a brief description of some of the irritant poisons will be given.

COPPER SALTS.

Pure metallic copper is not poisonous ; the salts in common use are the sulphate, the acetates, or artificial verdigris, and the carbonate, or natural verdigris, which is formed on copper utensils by the action of air and water. The symptoms produced by a poisonous dose of a salt of copper are these of irritant poisoning as above described, there is a metallic astringent taste in the mouth, the vomited matter may be coloured greenish, or bluish, headache and convulsions may be marked.

FATAL DOSE is not known ; an ounce of the sulphate has killed, and the same amount of the acetate.

The following is the only case of poisoning, by a salt of copper, met with in the last eight years in the Calcutta morgue. I exclude arsenite of copper as belonging to arsenic more than to copper :—A Eurasian female, being constipated, took a dose of what she thought was Epsom salt one morning, and had frequent stools that day; on the following morning, she vomited for the first time, the stools continued. About noon, she became very low, and, at 3 P.M., was removed to hospital where she died shortly after admission. The medical officer of the hospital, who admitted her, considered the case to be one of cholera, but did not give a certificate. The body was sent to the morgue, and a post-mortem examination held the next morning. Death rigidity was present only in the legs, the body was emaciated, the fingers wrinkled and cyanosed. There was blood of a dark tarry description, in both sides of the heart. On section, the cut surface of the lungs was dry, with spots of tarry blood exuding from the divided vessels. The peritoneal coat of the stomach and small intestine was of a greenish blue colour. The large intestine was empty and contracted. The stomach contained 4 ozs. of greenish blue fluid; in the small intestine, there was a small quantity of putty-like matter of a bluish colour. The mucous membrane and the walls of the stomach and small intestine were of a blue colour. There was no congestion of the stomach or intestine. From the fluid in the stomach, 60 grs. of sulphate of copper were recovered on analysis.

In some of the recorded cases of poisoning by salts of copper, inflammation of the mucous membrane of the stomach and intestines has been found; in others, as in the case above described, only staining was present.

TREATMENT.—If vomiting does not occur, emetics should be given, the stomach pump may be used, milk and white egg should be administered freely, the albumen forms an insoluble albuminate of copper. Alleviate pain and support the patient.

CHRONIC COPPER POISONING.

The long continued introduction into the system of minute quantities of copper has produced, in some persons, chronic poisoning. The symptoms are gradually increasing general ill-health, dyspepsia, colic, attacks of diarrhœa, a constant metallic taste in the mouth. The patient becomes weak, anæmic, the skin has a jaundiced appearance, the perspiration may stain the shirt a bluish green. The gums are retracted, with purple coloured edges. If the absorption of the copper continues, the symptoms become more marked, and the patient gradually sinks.

In India, sub-acute poisoning by copper is not uncommon from the use of copper vessels in cooking, there seems to be no danger, provided the utensils are kept clean and food is not left in them after cooking, but, having regard to the carelessness of Indian cooks, it is advisable to have all copper utensils coated with lead-free tin, renewed at regular intervals.

The treatment of chronic copper poisoning is to put a stop to the introduction of the poison, support the patient, and treat the symptoms. Milk is recommended as a prophylactic.

Lead.

Acute poisoning by lead is very rare ; the symptoms which are produced by a large dose, an ounce, of a salt of lead, are those of irritant poisoning ; there is no purging, the pain in the stomach is very severe, and of a colicky character, relieved by pressure. There is great prostration, most of the cases recover ; the fatal dose is not known.

The post-mortem appearances are those of gastro-enteritis, the mucous membrane of the stomach may be covered with a whitish grey deposit, erosion of the stomach and intestines has been observed.

Treatment —Remove the poison from the stomach by emetics, or the stomach pump ; dilute sulphuric acid may be given, with the object of forming an insoluble sulphate of lead. Magnesia sulphate may be given for the same purpose and to purge so as to remove the insoluble sulphate. Relieve pain by opium and demulcents.

Chronic Lead Poisoning.

Persons employed in lead factories and in various industries, in which lead is used, not infrequently suffer from chronic lead poisoning. The condition may also arise from drinking water, stored in leaden cisterns, or carried through lead pipes, from food contaminated with lead, from the use of hair dyes and cosmetics containing lead.

All ages are attacked, children are relatively less liable ; women are more susceptible than men.

The lead gains entrance to the system through the lungs, digestive organs, and the skin, but the chief channel is the digestive system.

SYMPTOMS.—The manifestations of chronic lead poisoning are very varied; in some cases, the symptoms are acute, there is rapidly developing anæmia, great gastro-intestinal disturbance, vomiting, constipation, followed after a time by diarrhœa, great abdominal pain, the urine is albuminous and contains casts. Death may occur in two or three weeks. In cases of this type, which may be termed subacute, inflammation of the intestines is found.

In the chronic forms, there is dyspepsia, loss of appetite, colicky pains in the abdomen, the tongue is furred, the breath foul, a sweetish taste in the mouth, a blue line at the margin of the gums. The patient emaciates, and develops a cachectic appearance, there is anæmia; from time to time, attacks of severe abdominal pain are experienced, the pain is paroxysmal and relieved by pressure; during the attacks of colic, the pulse is increased in tension, the heart's action slow. After a time, paralysis of muscles, pains about the joints, and encephalopathy come on, as a rule, not equally marked; in some cases, nervous symptoms are pronounced, in others, arthralgia; the paralysis is generally confined to a group of muscles, those most commonly affected are the extensors of the forearm, causing the characteristic wrist-drop, other groups involved are the muscles of the shoulder, those of the thumb, those of the outside of the leg.

Encephalopathy is the term applied to a series of symptoms, the chief of which are headache, dizziness, sleeplessness, hallucinations, acute delirium, epilepsy, convulsions.

POST-MORTEM APPEARANCES.—The paralysed muscles are wasted, yellow, fatty, and fibrous, their nerves exhibit degenerative peripheral neuritis. Lead is found in the organs, which, as a rule, exhibit no characteristic alterations.

ANTIMONY.

Poisoning by antimony is very rare in India, the few recorded cases appear to have been accidental; even in Europe, it is not very common, the preparation of medico-legal importance is the double tartrate of antimony and potassium, known as tartar emetic.

Poisoning by tartar emetic may be acute, from the ingestion of a large dose, or chronic, the result of long continued administration of small doses.

ACUTE POISONING.—When a large quantity of tartar emetic is taken, the patient within a short time is seized with intense nausea, accompanied by great depression. Violent vomiting occurs, there is burning pain, and a feeling of constriction in the throat, a metallic taste in the mouth, intense thirst. The nausea is not relieved by the vomiting. There is pain and tenderness of the abdomen. The vomited matter is bilious, may contain blood. Violent diarrhœa sets in, the stools are watery, may be bloody. Cramps are experienced in the limbs. The intensity of these symptoms, in a short time, produces signs of collapse which in fatal cases becomes profound, though recovery may occur in apparently hopeless cases. Death has occurred in seven hours, usually it takes place in one to four days.

As with other poisons, the symptoms produced by tartar emetic may be anomalous, in some cases neither vomiting nor purging occurred, the patient exhibiting only signs of extreme depression.

FATAL DOSE.—2 grains have proved fatal to an adult.

POST-MORTEM APPEARANCES.—In the acute form of tartar emetic poisoning, the post-mortem appearances are those of acute gastro-enteritis.

TREATMENT.—Vomiting is generally profuse and may be encouraged by free administration of fluid. When absent, the stomach pump may be used. The most effective antidote is tannin, which should be given freely, tea, decoction of cinchona or other bark containing tannin may be used.

Pain should be relieved by opium.

CHRONIC POISONING.—The administration of repeated small doses of tartar emetic causes nausea, vomiting, purging, depression, and exhaustion, which may prove fatal. The records of criminal poisoning by tartar emetic show that the method usually adopted by the murderer is to give his victim small doses, sufficient to produce nausea, vomiting and purging, and when the effects are passing off to repeat the dose. The object being to give to the symptoms the appearance of a natural disease. The victim is gradually worn out, and dies of exhaustion. In the celebrated Pritchard case, the poisoner began to give his wife tartar emetic in October, she did not die until March, he sometimes stopped the administration, and even sent her away for a change, during which she improved. The poison was given in food and, about two hours after meals, vomiting occurred.

CHAPTER XVIII.

ARSENIC.

The element arsenium is a steel-grey, brittle metal, which is readily oxidized into arsenious anhydride, commonly called arsenic, or white arsenic. There are two other compounds of arsenium of medico-legal importance, the two sulphides, the red or realgar, and the yellow, orpiment, or king's yellow ; the poisonous quality of the sulphides depends on the amount of white arsenic they contain, which in ordinary specimens is very large, and may exceed fifty per cent.

ARSENIOUS ANHYDRIDE, WHITE ARSENIC, OR ARSENIC.

As met with in this country, arsenic occurs in irregular masses of different sizes, presenting an opaque white, or yellowish white appearance, moderately hard and brittle, looking somewhat like pieces of porcelain. It is odourless and tasteless. Some authors have described it as having a rough taste ; no doubt, coarsely powdered arsenic will produce a sensation of roughness, if rubbed between the tongue and palate, owing to the mechanical action on the nerves of common sensation, exactly as would be experienced if rubbed between the fingers, but this is not taste, the result of stimulation of the special sense. Arsenic is soluble in 100 parts of cold water, and in 10 parts of boiling water, from which most of the arsenic is precipitated on cooling. When powdered arsenic is thrown into water a white layer forms on the surface of the water. The solubility of arsenic is diminished by the presence of organic matter in the water ; it is less soluble in tea or coffee than in pure water of equal temperature.

Arsenious anhydride combines with bases, the salts being called arsenites. The arsenites of the alkalies are soluble in water, and very poisonous ; other arsenites are almost insoluble, hence the use of lime, magnesia, hydrated iron, as antidotes to poisoning by arsenic. The arsenite of copper is insoluble in water, but soluble in the fluids of the digestive tract, and is consequently poisonous.

SYMPTOMS OF ACUTE POISONING.—The symptoms do not come on immediately after the administration of the poison, there is an interval which is generally from half to one hour, but which may be very short, or may extend to several hours. The length of the interval between the taking of the poison and the onset of the symptoms is of great medico-legal importance, and will be referred to again subsequently.

The earliest symptoms are a feeling of depression and uneasiness in the stomach, quickly followed by severe burning pain in the epigastric region, which is increased by pressure. Nausea and vomiting come on soon, the vomiting is violent and frequent, but affords no relief to the pain and nausea. There is a sensation of constriction and dryness of the throat, thirst is intense, drinking gives no relief but only increases the violence of the vomiting. After the food contents have been expelled, the vomit consists of watery fluid, containing mucus, often bile stained, also frequently tinged with blood. In the vomit, particles of the poison, if administered in the form of coarse powder, may be seen, or more easily felt, when a lump of mucus is rubbed between the fingers. Soon after the onset of vomiting, purging supervenes, the stools, when the fæcal contents have been expelled, consist of watery fluid, often white like rice-water, due to the presence of mucus and disintegrated epithelium. The evacuations are attended by severe tenesmus. Blood is often present in the stools. The patient complains of the intense burning pain in the stomach, radiating over the abdomen. There are painful cramps in the limbs. He is very restless. The violence of the pain, vomiting, and purging exhaust the patient, and signs of collapse appear, the pulse is weak, may be imperceptible at the wrist, the skin is cold and clammy, the features pinched, the eyes sunken, the voice hoarse and low, the fingers shrivelled, the nails blue. The whole body has a cyanosed appearance. The symptoms of collapse become more marked, and death occurs ; the intellect may remain clear up to a short time of death, or the patient may sink into a state of semi-coma, or of coma for some hours before death.

The duration of the symptoms varies, it depends principally, on the quantity of the poison, and on the resisting power of the individual. In fatal cases death usually occurs within 24 hours. On this point, the following statistics of the cases examined by me are of interest. In 49 fatal cases of arsenic poisoning (including yellow arsenic and arsenite of copper), the police reports show that in 22, death occurred in less than 12 hours from the administration of the poison; in 15, in from 12 to 24 hours; in 4, the duration exceeded 24 hours; and as regards the remaining 8 no information is available. Of the 22 cases which terminated in less than 12 hours, the larger number survived six to eight hours, the most rapid case lasted three hours.

In this country, in poisoning by arsenic, both suicidal and homicidal, very large quantities of the poison are administered, and a rapid termination is to be expected. Of the 4 cases, which survived more than 24 hours, in one, death occurred on the seventh day; in another, the duration was probably about a month, the man was ten days in Hospital.

The recorded cases of arsenic poisoning show that death may occur very rapidly, in one case in 20 minutes; on the other hand patients have survived for many days.

The symptoms produced by arsenic in poisonous dose are usually those of acute gastro-enteritis, due to the irritation and inflammation of the mucous membrane of the stomach and, to a less extent, of the intestine, set up by the poison. They present a close similarity with the symptoms produced by other causes, and, in some cases, it is impossible to distinguish arsenic poisoning from disease, except by analysis of the dejecta. The symptoms may so exactly resemble those of cholera that experienced medical men are deceived, the following is a very striking instance taken from the paper by Evans and Bose referred to previously:—"On the 28th October 1894, a man was admitted into the Mayo Hospital, Calcutta, suffering from symptoms of choleraic diarrhœa. He arrived alone and stated that he had come from Moorshidabad by steamer, having purchased and eaten food in the bazaar before leaving. He became ill on board the steamer. After admission, his symptoms were attributed by one of the medical officers to arsenical poisoning, but by three others who also examined the patient, from time to time, he was considered to be suffering from choleraic diarrhœa. The man died on the 4th day after admission, and a post-mortem examination was held. The condition found was one of general congestion of the alimentary canal, with ulceration of the stomach, and ecchymosis over the columnæ carneæ of the heart.

Portions of the viscera were sent to the Chemical Examiner for analysis which revealed the presence of arsenic."

In another instance, the deceased, a European, was admitted to the Medical College Hospital at 11-30 A.M. and died at 2-15 P.M. the same day ; the case was considered to be one of cholera, a certificate was granted, and the body was buried. Subsequently, some persons stated to the police they believed the deceased had been poisoned, the body was exhumed and a post-mortem examination held. Decomposition was advanced, death having occurred four days before, the mucous membrane of the stomach presented several large patches of ulceration, near the pylorus and along the lesser curvature. The viscera were sent for chemical analysis and arsenic was found. Suspicion fell on the wife of the deceased, she was committed to the sessions by the Police Magistrate, but at the High Court, the case was struck off by the presiding Judge.

It is not to be understood that every case of arsenic poisoning closely resembles cholera; it is only in exceptional cases that the symptoms present close similarity; as a rule, the diagnosis can be made by the presence, in arsenic poisoning, of the following symptoms :—The burning character of the pain in the stomach, and great tenderness on pressure over the epigastrium, the vomiting preceding purging, the feeling of constriction and dryness in the throat, the presence of bile and blood in the vomit, and in the stools, very often particles of the poison may be seen or felt in the vomit. The marked tenesmus. The history of the onset of the symptoms within a short time, an hour, or, more often, much less, after food, or drink was taken, and the rapid increase of the symptoms.

It must be recollected that in homicidal cases, the information given to the medical man may be deliberately untrue, with the object of deceiving him.

In most cases of poisoning by arsenic, the symptoms are of the type previously described, acute gastro-enteritis, followed by collapse and death ; but occasionally, the poison affects the nervous system, vomiting, purging, and burning pain in the abdomen, are altogether absent or of a slight character. The patient experiences vertigo, dimness of sight, severe headache, pains in the back and limbs, faintness, stupefaction, and in a short time, falls into a condition of profound depression of the vital powers, the limbs may be paralysed, convulsions of a clonic character may occur, death taking place in a few hours, or even more rapidly. The following extremely rapid case is mentioned by Dr. Van Geyzel, in his annual report for 1888, as having occurred at Hyderabad. The case is quoted by Gribble and Hehir : " A nautch girl was treated to a glass of brandy and subsequently to some other liquor. In a few minutes she fell back insensible and died almost immediately. Arsenic was found in the viscera. The absence of any gastro-intestinal symptoms is a noteworthy feature of this case, and it appears to be an example of an uncommon form of arsenical poisoning, in which the nervous system is affected; the subject becoming comatosed as in opium poisoning."

Cases have been recorded in which the individual has fallen asleep and passed into a state of coma, death occurring within a few hours. Lyon mentions several cases in which irritant symptoms were very slight, a woman vomited once, there was no purging, and no redness of the mucous membrane of the stomach and intestine ; in another case, there was fever, severe pain in the abdomen, no vomiting and purging, the nature of this case was not recognised by the medical man in charge, which is not surprising.

A combination of gastro- intestinal and nervous symptoms may occur ; in some cases, the former, in others, the latter predominating. In 1901, I examined the body of a woman ; from police report and subsequent inquiry, it appears that being discontented, owing to her husband having married a second wife, she took arsenic, in the afternoon, during his absence, and vomited and purged several times. When the husband returned, he found her asleep, and woke her up to prepare his food, she told him she was not well. He left her, and shortly after, on going in to the room, found her dead. The stomach was acutely inflamed all over, and contained 8ozs. of fluid, with lumps of mucus, in which gritty particles of arsenic were found ; there were particles also adhering to the surface of the stomach, and in the small intestine ; the endocardium of the left ventricle presented large sub-endocardial hæmorrhages.

In another case, examined in 1897, the police report states that the deceased, a woman, was unhappy owing to her husband absenting himself. He returned home one morning, and found his wife in low spirits, he asked her the reason, she gave none. Shortly after she fell down, the husband thought she was suffering from hysteria, and treated her accordingly, she then complained of a burning sensation in her stomach and chest. Though closely questioned, she would say nothing more. A medical man was sent for, but she died before he arrived. On post-mortem examination, the stomach was acutely inflamed, contained bilious mucus fluid, and particles of white arsenic. Though not mentioned in police report, it is probable that purging took place, the large gut was contracted and empty, the small intestine contained much mucus, in which particles of white arsenic were found. There was marked sub-endocardial hæmorrhage in the left ventricle.

In 1893, fifteen persons were accidentally poisoned by arsenic, one, a child, died. On post-mortem examination, no sign of irritant poisoning was discovered, the stomach and intestines were healthy, showed no sign of irritation, the stomach contained a little fluid, the intestines were filled with fæces. Arsenic was discovered in the viscera on analysis. The child had been treated in hospital, and vomiting induced ; there was no purging.

At present the causes which produce these anomalous manifestations of the action of arsenic are unknown ; they have occurred when the poison was in solid form, and when it was in solution ; the quantity seems to have no influence, if a large quantity was the cause, anomalous cases would be common in India where large doses are the rule, both in homicide and in suicide. The state of the stomach does not seem to be a factor of much importance, anomalous symptoms have occurred when the poison was taken on a full stomach, and on an empty one. Von Hofmann believes that conditions which promote rapid absorption, favour the manifestation of nervous symptoms ; arsenic in solution and an empty stomach are favourable. But the essential factor appears to be a constitutional peculiarity, or idiosyncracy, of the individual ; the rarity of anomalous cases makes this explanation the more probable, for we occasionally meet with persons in whom small medicinal doses of arsenic produce unusual effects, it is probable that in such persons the manifestation of a poisonous quantity would be anomalous.

Fatal Dose, 2 grains have killed.

In India, the poison is generally administered in solid form, coarsely powdered; a curry stone is commonly used to powder it. In homicidal cases, the poison is generally given in food; having neither taste nor odour, it is easily concealed. Its administration is also made easier by its compactness; a pinch of powdered arsenic is about 16 grains, eight times the fatal dose, a teaspoonful weighs about 160 grains.

In this country large quantities are administered, both in homicide and in suicide. Among the cases examined in the Calcutta morgue, in many, a very large quantity of coarsely powdered arsenic was present in the stomach and intestine; in a case of suicide there was not less than an ounce; in a case of homicide, 42·2 grains were recovered from the stomach. The deceased lived about 6 to 8 hours after the poison was taken, and had vomited and purged profusely.

The quantity of the poison found in the body is no criterion of the amount taken; by vomiting and purging much is got rid of without having been absorbed; and of the portion absorbed elimination by the stomach and intestine probably begins at once, and if the patient survives some time, the kidneys, liver, and other glands come into action, though during the intensity of the symptoms their activity is probably entirely suspended.

Treatment.—The first indication is to assist the removal of the poison from the stomach, before it has been absorbed. Vomiting may be encouraged by warm water, emetics may be given, and if the case is seen early, the stomach pump may be used, but its employment requires great care. However violent the vomiting may be, some of the arsenic, unless it was taken on a full stomach, will remain, the particles adhere to the surface and get imbedded in the mucus, and are not dislodged even by the stomach pump. Means should, therefore, be adopted to transform the arsenic in the stomach into an insoluble arsenite, time is of the first importance, and therefore the means at hand should be employed. Lime can usually be obtained, and should be given freely with water. The best agent to precipitate the arsenic is freshly made ferric hydrate, which may be prepared by adding carbonate of soda dissolved in water, to tincture of the perchloride of iron, the mixture should be strained through a cloth. The ferric hydrate remains on the cloth, and after washing should be given by the spoonful; to be of benefit it must be used in large quantity. Dialysed iron in doses of an ounce may be given but is not as beneficial as the freshly prepared ferric hydrate.

Liquor ammoniæ, or carbonate of potassium will serve to precipitate the ferric hydrate.

Treat the symptoms, relieve pain by opiates, and support the patient's strength.

The PROGNOSIS is bad. Although vomiting, as a rule, takes place soon after the poison is swallowed, the whole quantity is rarely removed, especially if the stomach was empty, as the particles of arsenic adhere to the mucous membrane and are not dislodged by vomiting nor even by the stomach pump. The most favourable cases are those in which the poison was taken on a full stomach and vomiting occurred promptly. Prognosis is worse in India than in Europe owing to the very large quantities of the poison used, both in suicidal and in homicidal cases.

POST-MORTEM APPEARANCES.—When death has occurred after profuse vomiting and purging, the body has a shrunken appearance, the features are pinched, the eyes sunken, the skin of the fingers and toes shrivelled, the nails blue. On reflecting the parieties from the chest walls, the tissues have a dry appearance, the surface is dotted with drops of dark, thick, tarry blood, which have escaped from the divided veins.

The peritoneal coat of the stomach may be congested ; in some cases, deep red patches are visible through it, especially on the posterior surface ; the veins are distended.

The colon is, as a rule, contracted and empty, it has an appearance like the gut of a fowl.

The small intestine may be moderately filled but more often it is empty. The peritoneal coat may be pink from congestion.

The right side of the heart, the pulmonary artery, and great veins are distended with dark fluid blood. The left ventricle is usually empty, and patches of subendocardia hæmorrhage are constantly found on the posterior wall, and at the bases of the columnæ carneæ. These patches are of a dark red colour, and are due to extravasation of blood beneath the endocardium. In my experience they are generally present ; they were found in 20 out of 22 cases, which had a duration of less than twelve hours, and in 36 out of the whole 49 cases, that is in over 73 per cent.

Dr. Chuni Lal Bose reported a very remarkable appearance in the heart of a case of arsenic poisoning, sent for chemical analysis in 1891 ; the lining of the ventricles was covered with a yellow deposit of arsenic. In a case of arsenic poisoning recently examined, I noted on the jejunum, beneath the peritoneal coat, several rings of a bright yellow colour, apparently due to a deposit of yellow arsenic, the body was highly decomposed, as was the case described by Dr. Bose.

Subendocardial hæmorrhages are not confined to poisoning by arsenic ; they were present in a case of poisoning by Nerium odorum, and also in a case of death from hæmorrhage, due to rupture of the spleen and liver. They have been observed in cholera, but though during the last 17 years I have examined a very large number of cases of that disease, I did not come across them once. Subendocardial ecchymosis is, I consider, a valuable sign of arsenic poisoning.

The stomach affords the most important signs of arsenic poisoning. The appearances are those of acute gastritis, the mucous membrane is acutely inflamed, swollen, the vessels congested, the colour is red, in some cases uniformly bright red, more often a deeper red is observed about the pylorus and on the posterior wall. The surface is covered with mucus which must be removed before the intensity of inflammation can be seen. In the mucus, and adhering to the surface, particles of the poison are commonly found, around them the inflammatory appearances are more intense, and frequently the epithelium is eroded. Throughout the mucous membrane, but especially about the pylorus and on the posterior wall, small hæmorrhages are found ; in some cases, in which the inflammation was very marked, considerable extravasations of blood were observed ; in a few cases, large erosions of the surface.

The extent and intensity of the inflammation vary ; in some cases, it is confined to the neighbourhood of the pylorus, sometimes only small patches or streaks of inflammation are discovered. The stomach may be in folds and the inflammation only on the summits. If the individual lived for one or two days ulceration of the mucous membrane may be found.

The contents of the stomach are usually blood stained fluid, with masses of mucus and blood clots floating in it. Particles of the poison will be found in the mucus.

The duodenum is inflamed, it presents appearances similar to those of the stomach but less intense. In the jejunum, there may be marked congestion, uniform above, in patches lower down. The signs of inflammation in the ilium are seldom marked, scattered patches of congestion may be observed. Throughout the small intestine the epithelium is swollen and loosened, and shed in large amount. It is probable that the greater portion of this desquamation occurs after death. The contents of the small intestine are mucus fluid, may be blood stained, and in the mucus, particles of the poison are commonly observed.

The large intestine is contracted and empty ; in my experience, in none of the acute cases of arsenic poisoning was there any sign of inflammation in the colon or rectum.

The condition of the other organs, the brain, liver, kidneys, is not constant in acute arsenic poisoning. If the individual survives two or three days, cloudy swelling of the liver cells, and parenchymatous nephritis, may be observed.

The foregoing account of the post-mortem appearances is based on the cases examined in the Calcutta morgue. As already mentioned, the extent and intensity of the inflammation vary ; further, in some rare instances, there may be no sign of gastro-intestinal irritation ; one example of this has been referred to previously, the child who with a number of persons was accidently poisoned, the stomach and intestines were healthy, there was no subendocardial ecchymosis. In another case, a man was found shivering, and when asked what was the matter, replied that by mistake he had drunk liquor arsenicalis for spirits of chloroform. He became unconscious, was removed to hospital, where the stomach was washed out, he died in a few hours. There was no sign of irritation in the stomach and intestine, no ecchymosis of the heart. In the washings of the stomach and in the viscera arsenic and morphine were detected. Neither purging nor vomiting occurred.

The presence of morphine might be held to account for the narcotic type of the symptoms and the absence of signs of gastro-enteritis, but this is negatived by the condition found in two other cases, one of a man seen at 11 P.M. vomiting and purging and found dead at 6 A. M. the following morning. There was marked inflammation of the stomach which contained much coarsely powdered white arsenic and a mass of opium weighing 10 grains and several smaller pieces. There was a large patch of subendocardial ecchymosis in the left ventricle. The other concerns a woman who complained of pain and burning in the chest, apparently neither vomited nor purged, and died in a few hours; there were small scattered ecchymoses in the left ventricle, the stomach was acutely inflamed and contained particles of yellow arsenic. On analysis of the viscera, arsenic and a marked quantity of opium were discovered.

The following cases are interesting and show the effects of arsenic in solution. A woman of 35 years of age, and a young man were accidentally poisoned by tea or coffee made with water which had been boiled in a kettle containing arsenic. All the members of the household who had partaken of the tea or coffee suffered but only the two mentioned died. The woman lived about 14 hours, from the time of taking the poison, the young man about 24 hours. The woman's stomach was uniformly slightly congested on the posterior surface and about the pylorus. The stomach of the young man presented in all parts, small scattered patches of slight congestion. In both subendocardial ecchymosis was present in the left ventricle, and in both there were small scattered patches of slight congestion of the small intestine.

The symptoms in both were burning pain in the stomach, violent vomiting, and purging, the woman died in about 14 hours the man in about 24 hours. The cases were acute, attended by marked symptoms of gastro-intestinal irritation, yet the appearances of the stomach and intestine were slight congestion only. In these cases the poison was in solution, and was taken on an empty stomach, the tea and coffee were drunk at 7 A. M. Under these circumstances absorption would be very rapid, and consequently the congestion observed in the stomach and intestine was, probably, mostly produced during elimination of the poison from the blood.

When arsenic in powder is taken, it is dissolved slowly ; as a rule, in acute poisoning, particles are found in the stomach and intestines after death. The local action of arsenic is intensely irritant, it excites violent inflammation and in these cases we find the particles surrounded by a zone of inflammation of a more intense character than elsewhere in the stomach. Each particle may lie in a small erosion, due to the destruction of the epithelium ; and, not infrequently, considerable areas of erosion are observed. If the patient has lived sufficiently long, the continued local action of the poison may result in ulceration, usually superficial, but occasionally deep, and the intensity of the inflammatory process may be so great as to lead to the formation of sloughs of considerable size. The process and the results are similar to those which are produced by the action of an arsenical paste applied to a cancer, a treatment at one time in vogue. The destructive action of solid arsenic is illustrated in the following case :—On the 23rd of January 1895, the deceased, a young man, was picking cardamoms with his father, and found a piece of white arsenic which he swallowed, thinking it was chalk. He vomited and felt very ill, and was removed to the Medical College Hospital where he remained until the 26th. He left the Hospital though still ill. He complained of a feeling of dizziness and a burning sensation all over the body ; he died on the 30th, seven days after taking the arsenic. The body was examined the same day. It presented a general yellowish appearance, the lungs were œdematous, there were 4ozs. of serous fluid in the pericardium. The right side of the heart was full of fluid blood, the left side empty, the endocardium of the left ventricles was inflamed on the posterior wall. The liver was of a yellow colour, the kidneys were pale and fatty looking.

The stomach contained some dark, thick fluid. The mucous membrane was pale, except near the pylorus where there was a large circular ulcer, 2 inches in diameter, covered with a thick, black slough which was detached in places ; the slough was composed of the mucous and submucous tissues.

In November 1900, a man applied for admission at the

Medical College Hospital. He gave the following account of his illness:—About a month previously, he suffered from gonorrhœ, which was cured by Kobiragi medicines in about a week. When cured he purchased, from a grocer's shop, 90 grains of *sankhia*, or white arsenic. Half an hour after swallowing it, he was attached by severe vomiting, which continued for eight days, during which he was unable to retain any nourishment. The vomit was of the colour of bile; while the vomiting lasted he did not suffer from purging, but subsequently, he has had loose stools daily. He feels very weak, is giddy, and everything seems dark when he stands or sits up. There are aching pains and a sensation of burning all over the body.

On admission to Hospital, he was in a very weak condition, dull and apathetic, answered questions sluggishly, pulse and respiration very weak. His skin was scurfy, and his appearance was very cachectic, conjunctivæ had an yellow tint. In Hospital, he suffered from fever, temperature rising at times to 104° Fah; he passed tarry-looking stools; once or twice, the motions contained bright blood. He sank gradually, and died on the 10th of November.

On post-mortem examination, the body was emaciated, skin scurfy, the cuticle of the soles of the feet was separated in places and loosened generally. There were some small pustules on the face, and the eyelids were glued together by secretion, the conjunctivæ were jaundiced. The blood was fluid, the muscle of the heart was pale. The liver, spleen, and kidneys were congested. The lungs were very congested, and the trachea and bronchi were filled with frothy fluid.

The mucous membrane of the stomach was abnormally pale; on the posterior wall and along the great curvature, there were five depressed cicatrices, evidently resulting from healed ulcers, the largest was an inch and a half long by one third of an inch wide, the others were irregularly oval in shape. The ulceration had destroyed the mucous and submucous tissues, down to the muscular coat.

There was slight congestion of the duodenum, scattered patches of congestion in the colon, and in the rectum; the cæcum was pale.

The viscera were analysed, no poison was found.

I made inquiries and learnt that in some up-country districts, there is a belief that a large dose of arsenic, taken on a full stomach, is beneficial, provided free vomiting occurs; the first effect is to produce weakness but subsequently the man is rejuvenated in sexual power. The deceased was an up-country man, he had suffered from gonorrhœa, the discharge from which is looked on as very debilitating, it seems probable that he took the arsenic in the belief that he would regain the strength lost by the discharge.

Of the 49 cases of poisoning by arsenic previously referred to, in all the poison was administered by the mouth; white arsenic caused the death of 15 men, 8 women, and 1 child; yellow arsenic of 19 women. In the bodies of 5 women, arsenic in undetermined form was found, one child was poisoned by arsenite of copper.

It will be observed that all the cases of poisoning by yellow arsenic occurred in women, the reason is, probably, that women keep this substance for use as a depilatory, and are well acquainted with its poisonous qualities, which, as mentioned previously, are due to the presence of arsenious anhydride. The symptoms and postmortem appearances do not differ from those of white arsenic.

The case of poisoning by arsenite of copper occurred in a child about 2 years old, who was seen swallowing French green, a pigment used by his father, an idol decorator; the usual symptoms occurred rapidly, and death took place within 24 hours. The stomach exhibited patches of congestion, the contents of the intestine were of a green colour.

As to the character of these 49 cases of arsenic poisoning, most of them were suicidal, several were accidental, three were homicidal, and there were some in which the circumstances were very suspicious of homicide, one of these has been referred to in the chapter dealing with the general aspects of poisoning.

By whatever channel arsenic is introduced into the system, it acts as a poison if in sufficient quantity. At one time, arsenical pastes were used for the cure of cancer, lupus, and similar conditions, fatal poisoning not infrequently resulted, the symptoms were those ordinarily seen in arsenic poisoning, and on post-mortem examination, the stomach exhibited acute irritation and inflammation. When arsenic is absorbed into the blood, it is eliminated to a large extent by the stomach, and this organ exhibits a special susceptibility to its irritant action. When cancer pastes were in use, it was found that the danger of absorption was lessened by the application of strong paste, which excited violent local inflammation, caused rapid death of the tissue, and the pouring out of much lymph, by which absorption was prevented.

In India, arsenic has been used to procure abortion ; sometimes in pill for administration by the mouth ; more often as a local application, a piece of arsenic, or a paste made with it, is introduced into the vagina, the inflammation which results may cause abortion ; it is a very dangerous method, fatal poisoning has resulted from absorption of the poison.

Face powders, ointments, and lotions containing arsenic have produced poisoning, in some instances fatal. Children have been poisoned by sucking toys coloured with arsenical paint. Poisoning has been caused by particles of arsenic given off from wall papers.

The symptoms produced by long continued absorption of minute quantities of arsenic differ from those of the acute poisoning. The initial symptoms are, generally, disturbance of the gastric functions, loss of appetite, nausea, headache, and a feeling of general depression and malaise. After a time, the bowels are affected, colicky pains are experienced, attacks of diarrhœa occur. The individual becomes cachectic, feeble, his skin scurfy, there is itching and œdema of the eyelids ; skin eruptions appear about the axillæ, neck, groins, and face ; small ulcers may form on different parts of the body. In some cases symptoms of peripheral neuritis develop.

If the absorption of the poison still continues the symptoms described become more marked, the cachexia more profound, the nails become brittle, the hair falls off, and, unless the poison is stopped, the patient dies in a condition of general cachexia.

The symptoms differ in different cases, in some the gastric, in others the nervous phenomena are the more marked.

In Europe, rarely, if at all, in India, homicidal poisoning has been effected by the repeated administration of toxic but not fatal doses of arsenic. The quantity given produces gastro-intestinal disorder, severe but not greater than would be caused by unwholesome food, the symptoms are similar to those produced by what is called a bilious attack, and pass off in a day or two leaving the patient in a state of debility ; a second dose is given before the effects of the first are completely recovered from, and a return of the symptoms in aggravated form occurs. The further course of the symptoms depends on the poisoner ; if he continues to give the poison, the symptoms become more severe and more of the character of acute poisoning, but if he intermits the dose, or gives a smaller quantity, symptoms of the chronic form of poisoning are likely to be observed—itching of the eyelids and conjunctivæ, irritable skin, redness of the throat and a feeling of something being stuck in it, causing constant hawking. The tongue which was at first coated, becomes red and irritable looking. The skin has a jaundiced appearance. Symptoms of peripheral neuritis may appear.

The duration of a case of this class varies and depends on the patience of the poisoner, if he gives the poison in small quantities, the symptoms become those of chronic poisoning ; as a rule, when the case has lasted a week or two a larger quantity is given, and death occurs rapidly with the symptoms of acute poisoning.

European records show that this method of poisoning has been practised, even when a medical man was attending the patient, and there is no doubt, the diagnosis is a matter of great difficulty if the poisoner has patience and refrains from large doses. If the medical attendant's suspicions are aroused, he can take steps which will quickly decide the question. The urine can be examined. If arsenic is being administered, the urine will contain it. Unfortunately for the patient the diagnosis may be made too late to save him.

The legal aspect, and the questions which arise in the trial of persons accused of administering arsenic homicidally, will be more easily described by giving an account of the evidence of the Chemical Examiner, Rai Dr. Chuni Lall Bose, Bahadur, and the Police Surgeon, in a case tried at the High Court of Calcutta a few years ago.

On the 16th of March, the Police Surgeon was requested to make a post-mortem examination, and the following particulars of the cause of death, as far as known, were furnished : " That the deceased had been ailing for a week with his head and suffered from slight fever ; that yesterday at about 1 P.M. he had an altercation with his wife, and went out, and stated he would take poison on account of his wife's misdemeanours ; that he returned at 2 P.M. smelling of liquor ; that at about 9 P.M., whilst in bed and not feeling well, his wife administered some medicine to him in some sugar, after which he had an attack of vomiting and purging ; that she repeated the medicine about 4 times ; that he was found dead at 4-30 A.M. to-day."

The post-mortem examination was made at 7-15 A.M., on the same day, about 3 hours after deceased was found dead. The body was well nourished, death rigidity present. There were slight abrasions on the right thigh and left elbow. The fingers were shrivelled, the nails blue. The lungs, liver, spleen, kidneys, and brain were congested. The right ventricle of the heart was full of fluid dark blood, the left ventricle was empty, and there was a patch of subendocardial ecchymosis on its posterior wall. The stomach was acutely inflamed, most marked at pylorus and along the lesser curvature ; in these situations, there were large patches of erosion. Gritty white particles were found adhering to the surface, and in the masses of mucus in the contents. There were 20 ounces of reddish fluid, containing masses of mucus, in the stomach.

There was no redness of the duodenum and intestines, the contents of which were watery yellowish fluid, not bloody ; bladder empty.

The opinion given immediately after the examination, was that deceased died of irritant poisoning, probably due to arsenic.

The viscera, including the stomach, its contents, the liver, kidneys, heart, were retained in sealed jars for chemical analysis.

The investigation by the Coroner, and by the Chief Presidency Magistrate resulted in the wife of the deceased and a young man being committed for trial to the sessions, at which the young man was struck out of the charge, and the woman alone was tried. The prosecution was conducted by the Government Prosecutor ; the prisoner was defended by a very able and experienced European member of the Calcutta bar.

To economise space, questions are not given when they can be clearly inferred from the answer. On the right of the page, the evidence given in Court is printed, on the left half quotations from books, and comments by J. B. G.

Dr. Chuni Lal Bose.

Examination-in-Chief.—I am a Chemical Examiner to Government, and have held the appointment since 1893, and that of Assistant Chemical Examiner since 1886.

I received seven sealed jars containing viscera, on the 17th March, from an Inspector of Police, the seals were intact. The viscera consisted of the stomach and contents in 2 jars ; the liver, kidneys, and heart, 7 jars in all said to belong to the deceased.

I detected arsenic in the viscera. I estimated the arsenic present in the stomach and its contents, and found it to amount to 42·2 grains of arsenic. Besides this quantity, there was arsenic in the liver, kidneys, and heart.

I also received and examined a number of articles in connection with the case. Some articles of clothing and bedding bore stains, which looked like vomit and fæcal matter, I detected arsenic in the stains.

Solubility of arsenic according to the *B.* Pharmacopœia
in 100 parts of cold water
in 10 parts of boiling water.
Taylor ½ grain to the oz. of cold water
12 grains to the ounce of boiling water.
Von Hofmann 1·75 of cold water.
1·10 of boiling water.

The arsenic in the stomach was white arsenic both in solid and in liquid form.

Arsenic is with difficulty soluble in cold water.

I found arsenic in solid form adhering to the coating of the stomach ; the liquid contents also contained arsenic.

The contents were a thick and dirty brown fluid.

Arsenic has no taste.

It is a heavy substance, if white arsenic is powdered, 42 grains would be about a quarter of a teaspoonful.

White arsenic could be made into a pill with glutinous matter.

If arsenic had been given in pill form, it would depend on the solubility of the material used in making it whether the pill would be found in the stomach after death.

When arsenic has been taken into the stomach, it first acts on the coating of the stomach, it causes irritation and subsequent inflammation.

Of the bottles I received, 22 were empty, 47 contained various homœopathic and British Pharmacopœial preparations among them some poisons ; solution of arsenic known as Fowler's solution ; wine of antimony ; morphine, solid and in solution in 2 bottles ; a bottle of chlorodyne ; a bottle of tincture of Hyosciamus.

If solid arsenic is found in the stomach, it must have been taken in the solid form, but if only arsenic in solution is present, it may be derived from arsenic taken in solution, or from solid arsenic dissolved in the stomach.

Fowler's solutions is white arsenic, carbonate of Potash, and lavender or cardamoms, and water; if Fowler's solution was taken, solid arsenic would not be found in the stomach. In this case, the arsenic I found could not have been due to taking Fowler's solution.

White arsenic is procurable in Calcutta in shops.

A thick layer of mucus would no doubt delay the action of arsenic by keeping the particles from contact with the surface, but this could only be for a short time.

Taylor, page 260, Vol. I., Edn. 4th. relates a case of a drachm of arsenic, taken on an empty stomach, yet symptoms were delayed for 3 hours ; the other cases referred to by Counsel, *vide* page 261.

Taylor, 4th Edn., page 262, Vol. I.

It is probable that in addition to the condition of the stomach, the onset of symptoms depends on the state of the arsenic, whether in solution or in solid form.

Taylor, 4th Edn., Vol. I., page 262, quotes from Flandin, Vol. 1st, page 535, "the case of a young female in whom no symptoms occurred for eight hours ; then there was violent vomiting ; on post-mortem examination a cyst of the mucous membrane containing arsenic was found in the stomach ; the poison having become sheathed over."

A very extraordinary case ! Was there a diverticulum ?

Outlines of Medical Jurisprudence for India, by Gribble and Hehir, page 411, para 640 : "If mixed in large quantities, the food is said to acquire a roughness of taste."

Ringer, page 281, 7th End. : "The post-mortem examination in acute arsenical poisoning shows much inflammation of the stomach, often in patches in which arsenic powder is visible imbedded in the thick viscid mucus and acccording to Harley the arsenical mischief is most marked at the cardiac end."

CROSS-EXAMINATION BY COUNSEL FOR THE DEFENCE.

Hyosciamus niger is used in cases of mind disorder, delirium, and in that class of case, and in conditions of various kinds where a soothing remedy is indicated.

Wine of antimony is poisonous if sufficient quantity is taken.

The action of arsenic is modified by the state of the stomach.

A thick coating of mucus on the stomach would prevent the action of arsenic for a time ; I cannot say for how long.

It is very unusual for the symptoms to be delayed if the stomach was empty.

Taylor's Medical Jurisprudence is a recognised authority. I know the book. You are aware, it is recorded in Taylor, of instances of drachms of arsenic being taken, and symptoms deferred for 2 hours ; also a case where symptoms did not appear for 5 hours ?

There is a case on record where the symptoms did not appear for 10 hours, it is in Taylor, that is the longest period on record.

According to medical knowledge and my experience, the time in which the symptoms appear varies and depends on conditions of the stomach.

When arsenic is taken it is found covered over with cyst ?

Taylor mentions one case of this kind.

I read of the case of cyst in Taylor, and nowhere else. From the description, I understand, the mucous membrane formed the cyst.

Arsenic to poison must get into the blood, anything which delays its getting to the mucous membrance and into the blood, will delay the action of the poison.

I received the stomach about 11 or 12 A. M. on the 17th ; the reddish fluid looked like what one finds in the stomach in arsenic poisoning.

Arsenic is tasteless.

I do not agree that it has a roughish taste. I have tasted it myself in small quantity ; there may be a roughness if a large quantity is taken into the mouth. As to the statement of Gribble and Hehir, I cannot say I have not tasted it in large quantity. The late Professor of Medical Jurisprudence made experiments, he said it had no taste.

I know Ringer's Therapeutics, it is a standard work (quotation read). I agree with what he says except that it is not in my experience that the signs are most marked at the cardiac end.

My experience also is against the statement of Harley.

Ringer, page 281 : "The œsophagus and intestines may undergo inflammation often most severe in the rectum."

The rapid onset of symptoms is, in my experience, usual in cases of poisoning by arsenic in this country.

Woodman and Tidy, page 134, solubility of arsenious acid. 1000 grains of water boiled for an hour, the quantity being kept uniform by the addition of boiling water from time to time, and filtered immediately

dissolved grains 64·5 of transparent form.
,, ,, 76·5 of opaque form.
,, ,, 87·0 of fresh crystalline acid.

Judging from the frequency with which particles of solid arsenic are found in the stomach, even in cases lasting 24 hours, solution in the stomach is slow. Particles are often found in the small intestine ; particles of sufficient size to be easily seen and felt.

The cardiac end is where the stomach joins the gullet.

As to the action of repeated doses of arsenic on the gullet, in some cases there is inflammation but not in my personal experience.

RE-EXAMINATION BY COUNSEL FOR THE PROSECUTION.

The usual time for the symptoms to appear is in from half to one hour after the poison is taken.

Those cases of long interval mentioned by Taylor are exceptional and do not refer to average cases.

Do you agree with this statement? It has been known to appear in quarter of an hour. Yes. It is recorded by Christison that the onset of the symptoms can take place in 8 minutes, and in two of his cases the symptoms began almost immediately.

As a general rule when the symptoms begin they continue.

Arsenic is sold in masses, like white porcelain ; it can be powdered. I agree that at page 261, it is described by Taylor as having an acrid taste, but this does not appear to be correct, a small quantity has no appreciable taste.

I agree that it has been taken in food, in fatal quantities, without exciting any perceptible symptoms on the tongue. If it has no taste in small quantity, it would have none in large quantity ; the sensation of roughness produced by it would depend on how much it has been powdered.

I would say inflammation of the gullet was an unusual symptom.

TO THE JURY.

In milk, arsenic would not dissolve to greater amount than in water. Arsenic boiled in milk, a larger quantity would dissolve than in cold milk but there is a limit to the solubility. About 12 grains would be dissolved in boiling milk per ounce. If you boil the milk and arsenic, for many hours not more than this amount would be dissolved.

What are the effects of the gastric juice of the stomach on arsenic and how long will it take to dissolve?

The gastric juice dissolves the arsenic to a certain extent. I cannot say how long it will take. A solution of arsenic is more rapid in action than solid arsenic. Arsenic once dissolved does not precipitate again, that is in the system.

Examination-in-chief of the Police Surgeon.

I have been Police Surgeon for three years. I have been in India since 1882, in the Indian Medical service. I examined the body of——identified to me by a police officer. These notes were made at the time of the post-mortem examination, they are in my handwriting and are correct.

(Permission given to use the notes to refresh the memory.)

(Post-mortem appearances described, see before.)

The signs of poisoning were more marked at the pyloric end and along the lesser curvature. The pyloric end is the end which joins the intestine.

On the surface of the stomach, and in the mucus masses in the contents, there were gritty particles, they were small and I felt them before I saw them ; I felt them when I rubbed the masses of mucus between my fingers. There was erosion or superficial destruction of patches of the surface, along the lesser curvature.

The gullet was healthy.

Inflammation of œsophagus is very rare in arsenic poisoning.

I kept the viscera in 7 jars, closed, and sealed in my presence, and made over by me to the Inspector of Police.

The gritty particles in the stomach were like arsenic.

I have heard the result of the chemical examination of the viscera.

My opinion is that deceased died of poisoning by arsenic. My reasons are—in the first place, in the post-mortem room from the appearances found, I formed the opinion that deceased died of irritant poisoning, probably by arsenic. The presence of gritty white particles in the stomach, and the blood staining under the lining of the left chamber of the heart, pointed to arsenic as the irritant.

Ordinarily there are no gritty particles in the stomach.

When arsenic comes in contact with the surface of the stomach, it causes irritation, it is absorbed and carried into the system and the body generally.

When does arsenic take effect and pass into the system ?

That depends on the rapidity with which the arsenic is dissolved ; it must be dissolved before it can pass into the system. In the gastric juices it is as soluble as in water.

Juices are being constantly poured out and taken up again in the stomach ; if there is arsenic present, it is dissolved and taken into the system.

Fluids would be medically a more correct word to have used, as juice is generally taken to mean the secretion of the gastric glands which occurs only under special stimulus.

Complete solution and absorption of solid arsenic is slow, takes a long time, but some is quickly dissolved and absorbed.

The resisting power of the patient is also an important factor.

Arsenic on the intact cuticle causes no irritation, but if by rubbing, or in other way, the surface is broken and the arsenic gets to the deeper layers of the skin an acute inflammation is caused. Absorption of solution of arsenic, or of arsenical ointment can take place through the intact skin.

The time required for absorption is short.

The symptoms generally appear in from half to one hour after the poison is taken.

The first symptom is, generally, a feeling of heat and discomfort in the stomach. This is quickly followed by burning pain and vomiting, then later, purging and cramps, going on to collapse; that is the patient sinks into a state of depression, his skin is cold, pulse very weak, fingers shrivelled, nails blue, voice lost.

The time when collapse occurs depends on the quantity of the arsenic, a large quantity produces collapse soon.

The burning pain and discomfort in the stomach are due to the irritation caused by the arsenic.

If arsenic is rubbed on the skin so as to rub off the surface or hard skin, it causes inflammation and a sore is produced.

If arsenic was taken and vomiting produced by it, I would expect the symptom to go on, for it is very improbable that all the arsenic would be got rid of by vomiting and what remained would continue to irritate the stomach.

I do not think it is possible for the symptoms to stop, the arsenic left in the stomach would come in contact with the surface, for by the vomiting the stomach would be emptied of food and the pieces of arsenic would lie on the stomach and would go on irritating it.

I can understand that in some cases arsenic acts as a narcotic, then it would not cause vomiting or other symptoms of irritation, but if symptoms of irritation began I do not believe they would stop.

If arsenic is taken suspended in fluid, symptoms would appear on an average in half to one hour. If arsenic is taken suspended in fluid on an empty stomach, it would produce vomiting immediately, I mean a large quantity, 10 grains and upwards. In drinking, liquid reaches the stomach in a second or so.

If a person took upwards of 42·2 grains of arsenic and vomited at once, I should say the vomiting was due to the arsenic, and the symptoms would not then cease.

Suppose a person had between 6-30 and 7 o'clock drunk a cup of milk and immediately vomited and after vomiting he retired and laid down and talked telling stories, from one to one and a half hours after taking the milk, do you think that the drink could have contained 42 grains of arsenic or any fatal dose ?

I do not think so.

Arsenic has no taste, but if in coarse powder it causes a gritty sensation.

Arsenic can be powdered very fine. Of powdered arsenic 42 grains would be about a quarter of a teaspoonful. If mixed with sugar and camphor, a person taking arsenic would not be aware of its presence.

If in pill form there would be no taste. Arsenic has no taste. If arsenic mixed with sugar and camphor were given, and a drink of water immediately after, if 42·2 grains were thus given the action would be immediate.

If a person vomited after drinking a cup of milk between 5 and 7 P.M., and took nothing more, the stomach would be empty.

If arsenic mixed with sugar and camphor was swallowed, a drink of water would not assist its progress to the stomach, for it would have been in the stomach when the water was taken.

Swallowing is a rapid momentary act, a drink given after a solid substance has been swallowed, would not assist its progress to the stomach, but if the substance was still in the mouth or back of the throat, the drink would help the person to swallow.

If a person had taken white arsenic and vomited at once, the vomiting would indicate a large quantity.

The pains caused by arsenic are severe, and like those of cholera; but more severe and burning in arsenic than in cholera.

The pain is acute, of a burning character. The pain radiates from the stomach, cramps occur later. If the quantity of arsenic was large, pain, vomiting, purging, cramps would all come on quickly, especially if the stomach is empty.

A great deal of argument ensued between Counsel regarding the next question and before it could be formulated I had to leave Court, on return was asked.

Suppose a person while suffering from arsenic poisoning and after burning pain had come on, would pressure on the stomach cause pain? Yes, because the stomach is inflamed and pressure would hurt it.

When a person has taken 40 grains and upwards of arsenic collapse would occur soon, in 2, 3, or 4 hours, depending a great deal on the individual; he might remain in a collapsed stage, perhaps for hours without dying, or die in a short time.

If a person had drunk a cup of milk between 6-30 and 7 P. M. and there was a large quantity of arsenic 40 grains and upwards in it, would it be possible that he should have vomited only? I do not think so.

CROSS-EXAMINATION BY COUNSEL FOR THE DEFENCE.

What I have been stating is the usual experience in cases of poisoning by arsenic.

Whether the usual routine of symptoms occurs depends on various circumstances, the condition of the stomach, full or empty, state of health and vitality of the person.

Taylor, 4th Edn., Vol., page 463, "that even when the stomach has been found intensely inflamed after death the patient has not complained of pain during the time she survived."

Taylor quotes an interval of 10 hours, also a case in which symptoms appeared as the person was eating a cake which contained the poison.

Arsenic is sometimes an erratic poison.

Although pain is in general an early and well marked symptom, arsenic sometimes destroys sensibility, do you agree with this? Yes, I agree, but it is only when arsenic acts as a narcotic. I agree that there can be cases of arsenic poisoning where there is no vomiting or purging, and that sometimes it will produce a lethargic condition, that is what I meant by its acting as a narcotic.

Camphor is a stimulant, it would have the effect of heating and warming the stomach. It excites the circulation, that is stimulation. It would not stir up the action of arsenic.

In a patient with arsenic in his stomach a dose of Camphor would not affect the action of the arsenic, it might help absorption but not the local irritation.

It would increase absorption by increasing the general circulation, thereby improving absorption. In so far as it increased the quantity absorbed, it would increase the action.

The interval between the taking of arsenic, and the onset of the symptoms is generally from half to one hour.

There are recorded instances of much longer interval.

It is possible for arsenic to be introduced into the stomach and not to come in contact with the wall of the stomach.

It is by coming in contact with the surface of the stomach that arsenic, whether solid or dissolved, causes irritation.

The stomach, when empty, is usually in folds, but it may be relaxed and smooth. There is always some mucus in the stomach.

Quotation "On Irritant Poisons:" "The stomach is occasionally found ulcerated but comparatively speaking rarely." Yes; I agree.

A man may have an ulcer of the stomach for a long time with very slight gastric disturbance, particularly one form of ulcer.

Owing to the condition of the stomach, I cannot say what was its state during life before the poisoning; if cancer, or chronic ulcer had been present I would have seen it; but as to ordinary forms of disease, I could not say whether they had been present or not, owing to the inflammation due to arsenic.

The stomach contained mucus and inflammatory exudation. I could not say how much of the mucus was the result of the arsenic and how much was present before.

There is a use and an abuse of mucus.

Mucus is secreted by certain cells, it is their business or function, and it is secreted naturally, apart from inflammation; mucus has uses.

Dirty stomach, a condition of catarrh due to drink and errors in diet.

Ringer, page 277, quoted by Counsel: "In certain diseases of the stomach, few remedies are more useful than arsenic. In the so-called irritative dyspepsia, where the tongue is furred and its papillæ red and prominent a drop of solution of arsenic taken shortly before food will be found of great benefit. Administered in the same manner it will arrest the distressing vomiting of drunkards with almost unfailing certainty and simultaneously improve the state of the stomach and restore both appetite and digestion. This vomiting accompanied by great straining and distress usually occurs in the morning before breakfast, and mostly very little and sometimes nothing is ejected and then it is called dry vomiting. The vomit is generally intensely bitter, sour, of a green colour.

Outlines of Medical Jurisprudence for India by Gribble and Hehir, 3rd Edn., para 649, page 417. The words quoted form the first sentence, lower down in the paragraph Taylor's opinion is given.

Read out by his Lordship: "It, however, especially in India where very large quantities are given or attempted to be given in homicidal cases, by no means negatives homicide."

Taylor, 4th, Edn. Vol. I, page 284. "The editor has known an ounce of arsenic homicidally put into a pint of rice pudding. The pudding was eaten without suspicion."

Christison relates a case in which 90 to 100 grains were found in the stomach, administered homicidally in whisky punch.

Taylor, 4th Edn. Vol, I., page 257.

I could not say that the stomach of the deceased was what is called a "dirty stomach" in life time.

Catarrh, produced by too much food, or drink would result in an abuse of mucus. Common dyspepsia is attended with excess of mucus due to irritation caused by too much food, or drink, or bad food.

In drunkard's stomach, there is a condition of chronic catarrh and an excessive quantity of ropy mucus, an excess of mucus, just as in catarrh or running from the nose. It is this running or excess of mucus that causes nausea and sickness in the morning.

Are not minute doses of arsenic used as an antidote for the nausea and sickness of indigestion? Yes, one of the remedies.

Ringer's work is a standard authority on therapeutics.

I agree that arsenic is a valuable remedy for drunkard's dyspepsia.

The quantity of arsenic found in the body is no criterion of the quantity taken.

Has it not been noticed that larger doses have been taken in suicide than in homicide? No.

Quotation from Gribble and Hehir: "It has generally been noticed that in cases of suicide a far larger dose is taken than when the poison is given with a homicidal intent." I do not agree.

Lyon's work on Medical Jurisprudence is a standard work? Yes.

He states on page 149: "The discovery in the contents of the stomach after death of a large quantity of arsenious oxide to a certain extent indicates suicide."

I do not agree. I think that quotation does not give his meaning. I think a large quantity gives no indication of suicide or of homicide.

(His lordship asked for the book and read the next sentence which is quoted in the margin.)

Suppose a man taken ill with arsenic poisoning, vomiting, purging, etc., at 9 o'clock. I will not stake my professional reputation as to when the poison was administered.

Dimness of sight and swinging of the head are symptoms of dyspepsia. The usual order of the symptoms in arsenic poisoning is burning pain in the stomach, vomiting, purging, cramps, collapse?

Yes.

Taylor states that cramps are later than the other symptoms.

Yes. I agree.

The congested state of the liver was I consider, due to the arsenic poisoning.

If there was an excess of mucus coating the stomach, the action of the arsenic would be delayed to some extent.

In a drunkard's stomach you would probably find an excess of mucus.

I have said that arsenic will not operate until it comes in contact with the mucous membrane of the stomach, it is practically not in the stomach until it does.

RE-EXAMINATION BY COUNSEL FOR PROSECUTION.

In this case I found inflammatory exudation and mucus, how much of the one and how much of the other, I cannot say.

I cannot tell if it was a drunkard's stomach.

The other symptoms of dyspepsia are furred tongue, nausea, inability to take food.

When it was suggested that large doses indicate suicide the reason I did not agree was that you will find in Taylor and other authorities cases of homicide in which large doses, up to an ounce, were given.

The quantity found after death is no criterion of the amount taken, for by vomiting and purging much is ejected.

I have read of cases where the symptoms took longer than half an hour to appear and also cases where they began in less time.

If the stomach was full of food, and the dose of the poison small, the interval before the symptoms appeared would be longer than when a large quantity is taken on an empty stomach.

In an empty stomach, the larger the the quantity of arsenic taken, the sooner would the symptoms appear.

The larger the dose, whatever might be the state of the stomach as regards contents, the sooner would the symptoms appear.

Arsenic is erratic ; I have known a person to die of arsenic poisoning and no sign of irritation was found in the stomach.

Arsenic sometimes acts as a narcotic. The amount taken does not determine the narcotic action. Why it sometimes acts as a narcotic is not known.

TO THE JURY.

From the post-mortem appearances I am of opinion that the case was very acute ; and when the symptoms began, I believe, they continued.

What time elapsed between the administration of the poison and death ?

From my experience, I should think 4 to 8 hours, it would depend greatly on the resisting power of the man.

By the symptoms coming on quickly I mean within a few minutes after taking the arsenic.

The defence was conducted with great ability, the Counsel was experienced in Criminal Cases, and it was impossible to show that the accused had arsenic in her possession. The result of the trial was a verdict of not guilty.

Arsenic is said to have a preservative effect on the body and to retard putrefaction. This is not in accordance with my experience, I have not found any perceptible difference in the progress of decomposition in cases of arsenic poisoning, and in deaths from other causes. It will, of course, be understood that the comparison is made between bodies of similar physical characters, and at the same time of the year. When much fluid has been drained out of the body by vomiting and purging, the tissues are drier and to some extent more resistant to putrefactive changes, but this dry condition is not peculiar to arsenic poisoning. The onset and progress of putrefaction exhibit great differences. I have on several occasions examined the bodies of a number of individuals killed at the same time, by the same cause, and have been struck by the very marked differences in the signs of putrefaction found. In arsenic poisoning similar differences are observed. On the 26th of April, 1894, I examined the body of a female, aged 25 years, who committed suicide by yellow arsenic, and died in about 24 hours, the post-mortem examination was held 24 hours after death. Rigor mortis was present in all parts of the body, there was a marked odour of putrefaction, the conjunctivæ were softened and opaque. The lungs were softening ; the liver, spleen, kidneys, were decomposing. The coats of the intestine were softened. The blood in the heart was putrid, the substance of the heart softened. The stomach was considerably eroded, there were emphysematous blebs all over it, and the coats were softened from putrefaction. There were no particles of arsenic visible in the stomach or intestine, but on chemical analysis arsenic was discovered. On the 12th June, 1899, at 6-45 A. M. I examined the body of a female certified to have died in hospital at 12-30 P. M. the previous day, the conditions were the same as in the case above mentioned ; my note of the stomach is—distended with gas ; contents dark mucus ; much gritty particles, coarse and fine, of yellow arsenic ; mucous membrane inflamed in patches, softened from putrefaction, the inflammatory appearances mostly destroyed by putrefaction. The brain was putrid, like a mass of putty.

These two cases occurred at the hottest season when putrefaction occurs with extreme rapidity. In February 1901, I examined a body, death from white arsenic, the post-mortem was held 12 hours after death, yet I find in my notes, "distinct odour of putrefaction and softening of the tissues were present." I find the same remark regarding a case examined in February 1900.

In February 1895, the body of a European male was exhumed, three days after burial, and a post-mortem examination held four days after death, which was ascribed to cholera. Decomposition was advanced, the body was swollen; the cuticle peeling off, eyes putrid, gas bubbling from the orbits, nose, and mouth; the internal organs were putrid, the stomach exhibited large areas of erosion, black in colour, the walls of the stomach were softened, studded with emphysematous blebs. In this body, putrefaction was as far advanced as I have found it, in the same period, in death from other causes. The viscera on analysis were found to contain arsenic.

The cases mentioned are sufficient to prove that in the climate of Lower Bengal, the presence of arsenic has no appreciable effect in retarding the onset and progress of decomposition.

When arsenic is found in an exhumed body, the theory may be put forward that the poison entered the body after burial, from the soil. Arsenic is found in some soils but only in an insoluble form. Moreover, experiments made to test this question, prove that even under most favourable circumstances, the dead body does not become impregnated from contact with arsenical earth. (Taylor).

The following important extract from the annual Report of the Chemical Examiner, Madras, for the year 1902, has been recently circulated :—"Two persons suffered from choleraic symptoms, and one of them died and was cremated; but when the other one also died in a few days, suspicion was aroused. The viscera of the latter and all suspected articles connected with the case were sent for chemical examination, including ashes from the scene of the cremation. Arsenic was found in the visceral matter and excreta and even in the earth scraped from the spot where the washings of a tumbler had been spilt. Interest attaches to the fact that appreciable quantities of arsenic were easily detected in the ashes and bones from the scene of cremation contrary to expectation, for a volatile poison like arsenic would be dissipated by fire and lost beyond the possibility of detection in anything reduced to ashes; but the conditions under which cremation is usually carried out here evidently do not favour complete combustion, and sublimation of the volatilised arsenic on the cooler parts of the funeral pyre is liable to take place and its loss thus prevented. This is borne out by another such case, which was examined during the year, in which arsenic was easily detected in ashes and charred bones, etc., sent from the cremation ground. The point is one which is worth noting by magisterial and police officers who have to investigate cases of suspected poisoning, in which the corpse has been cremated."

CHAPTER XIX.

PHOSPHORUS.

Poisoning by phosphorus is very rare in India. In the Chemical Examiner's report for 1900, one case of attempted suicide by taking yellow phosphorus is mentioned. It appears a man mixed some poison with boiled potato but was prevented from taking it. The Chemical Examiner received a pasty ball of mashed potato of a pink colour, which on examination was found to be phosphorescent and gave all the reactions of free phosphorus. The Chemical Examiner remarks, "as yellow phosphorus is not ordinarily obtainable, it is most probable, judging from the pink colour of the mass, that the man mixed tips of lucifer matches with the mashed potato."

When a poisonous dose of phosphorus is taken, the person immediately, or within one or two hours, experiences pain in the stomach, followed by nausea and vomiting, the vomit is luminous in the dark, and so may be the patient's breath, which has a garlic odour. The pain and vomiting are very severe; there is great thirst, and a burning sensation in the throat. Symptoms of collapse may appear rapidly and the patient may pass into a condition of delirium, followed by coma, and death in a few hours. More often, the symptoms subside, the patient feels easier, vomiting occurs at long intervals. He is exhausted but otherwise greatly improved and appears to be recovering. After a time, which is usually one or two days, but which may extend to several days, or, it is said, to weeks, symptoms reappear; the eyes and then the whole of the body become jaundiced; vomiting becomes frequent, the abdomen is painfully distended; the liver and spleen are enlarged. The vomit is blood stained. Diarrhœa sets in, the motions are offensive and contain blood. Bleeding from the nose and mouth occur, there may be purpuric spots on the skin. The patient becomes restless and delirious; and after a time sinks into coma, and death follows.

The duration of a case is generally three to seven days, but may be prolonged to weeks.

FATAL DOSE.—One grain and a half of yellow phosphorus; the red or amorphous phosphorus is not poisonous.

POST-MORTEM APPEARANCES.—The odour of phosphorus may be observed. The stomach may exhibit signs of irritation, and the epithelium is in a state of fatty degeneration. Small hæmorrhages are found on the heart and other organs, and all over the body. The liver, if the patient died soon, is enlarged, the cells fatty. The fatty metamorphosis may be complete, no liver cells of normal appearance may be visible in a section. If the patient survived some time, the liver is small and fatty. Similar fatty degeneration of the renal epithelium and of the muscle fibres of the heart is found.

TREATMENT.—If seen before absorption has taken place the stomach should be emptied ; sulphate of copper may be administered, it will act as an emetic and also as an antidote forming with the phosphorus, a harmless salt.

Unrectified oil of turpentine in doses of half a drachm is recommended, Sanitas Fluid might be given.

The PROGNOSIS is bad.

Poisoning by PHOSPHORUS VAPOUR.—Work people in match factories and other places, exposed to the fumes of phosphorus, suffer from necrosis of the lower jaw. If appears that so long as the mucous membrane and teeth are intact, the fumes have no local effect, but if the periosteum is exposed by injury of the gum or by loss or decay of a tooth periostitis is set up. The bone undergoes necrosis. The foul discharge from the diseased bone acts on the general health, which is also affected by the phosphorus fumes ; digestion suffers from inability to masticate ; death may occur from exhaustion, or blood poisoning.

OPIUM.

Opium is the inspissated juice obtained by incision of the capsules of the *papaver somniferum* ; it contains a number of alkaloid and alkaloidal substances of which the principal are morphine, narceine, codeine, and narcotine. Morphine is the most important constituent ; the poisonous effects of opium depend chiefly on the quantity of morphine present, which, in the Indian variety, is about 4 to 5 per cent. The opium used in the British Pharmacopœia must contain, when dried and powdered, between 9·5 and 10·5 per cent. of anhydrous morphine, and for the tincture and extract not less than 7·5 per cent., these being standardised when prepared.

Opium is the most common poison used in India; in adults, the cases are nearly all suicidal; children are sometimes accidentally poisoned by opium, and it is also used as a means of infanticide, and for the murder of older children. Cases of opium poisoning are of frequent occurrence in Calcutta; during the period from June 1893 to May 1901, excluding three months absence on leave, I examined 307 bodies sent to the morgue as cases of suspected or known opium poisoning. It would, I believe, be erroneous to take these figures as representing all the deaths from opium during the period to which they refer; they show the cases which came before the Police Surgeon. It is more than probable that a considerable number of deaths from opium are disposed of as deaths from natural causes.

Of the 307 cases, in 78 solid opium was found in the stomach and it was not necessary to send the viscera for chemical analysis; in the remaning 229 cases, the viscera were sent to the Chemical Examiner, in many of them a strong odour of opium was noted in the stomach, in others minute fragments were present, but unless masses of solid opium were found, the viscera were analysed. The following figures show the result of the chemical examination: In 178 opium was found; in 9 opium and alcohol, the police reports in these cases indicated the presence of alcohol; in 1 opium and a trace of copper sulphate, the latter probably derived from a copper coin put into lime juice and water, used in treatment; in 13 morphine; in 2 morphine and alcohol; in 5 no poison was present in the viscera, but opium was found in the washings of the stomach. In 13 no poison discovered, and the opinion that death was due to opium poisoning was based on the history and post-mortem appearances; in several of these cases, the deceased had made a statement of having taken opium, and in one case of a child traces of opium were seen on the lips.

In the remaining 8 cases, no poison was found, and from the presence of disease and the evidence of witnesses at the Coroner's Court the opinion was given that death was due to natural causes.

The 299 cases of opium and morphine poisoning were made up of 169 men, 122 women, and 8 children.

As to the character of the cases, in not one was any suspicion of homicide brought to light either by the police inquiry, or at the Coroner's inquest; nearly all the deaths of adults were suicidal, some were possibly accidental, though it is difficult to believe that an adult in this country could take opium by mistake; in a few death may have resulted from an over-dose. One child, a boy 10 years old, apparently committed suicide, his stomach contained a large quantity of opium, he had access to opium kept in an unlocked box, and had been reprimanded for some fault. The other cases of children were clearly accidental.

Symptoms.—Between the taking of the poison and the onset of the symptoms, there is an interval, usually of from half to one hour; it may be much shorter, especially if the opium was in solution and the stomach empty; on the other hand, an interval of several hours has been recorded, Christison mentions a case in which the symptoms were deferred for 18 hours. From the police reports of the cases examined by me, it appears that in several an interval of some hours occurred, but as a rule, the symptoms appeared soon after taking the poison, which was to be expected, having regard to the very large quantity usually taken in suicidal cases.

The earliest symptoms are rarely observed by a medical man; from the police reports and from evidence of witnesses, it appears that in many cases, the patient first complains of giddiness, and soon after, is noticed to be drowsy. When this is observed, opium poisoning is so common, the friends become suspicious, and question the person, and very frequently he admits having taken the poison, medical aid is summoned, or the patient is removed to Hospital; very often this step is taken on the advice of the medical man called in.

Drowsiness increases rapidly, the patient cannot keep awake, his eyelids close, sleep overpowers him. When roused, he answers questions slowly and sleepily, and again sinks into slumber. The muscular system is relaxed, his limbs are flaccid, he cannot stand, or walk; if he is stimulated and compelled to attempt to walk his limbs are unable to support him and unless held up he falls. The pupils are contracted; the pulse soft, the breathing shallow and slow; the skin is moist; the odour of opium may be present in the breath.

The sleep deepens into stupor, it becomes more difficult to rouse the patient. The contraction of the pupils becomes more marked; the pulse is quick and feeble; the respiration gets slower, laboured and stertorous; the face has a cyanosed appearance, the veins of the neck are distended. As the individual comes more under the influence of the poison, the symptoms increase, stupor passes into coma, all sensibility is lost, the breathing is very slow and stertorous, the pulse feeble, generally quick, but sometimes slow. After a time, coma is profound, the pupils dilate, the breathing assumes the type of the third stage of asphyxia, a sudden noisy upheaval of the chest wall, accompanied by contraction of the muscles of the neck and jaw, the head is pulled to one side, the lower jaw drawn down, followed by a sudden collapse of the chest wall; a long interval occurs, during which the patient appears to be dead, then another chest movement takes place, the intervals gradually lengthen, finally all movement ceases and the individual is dead. The final respiratory movement does not differ from those which immediately preceded it. In observing the last stage of opium poisoning, I have, many times, felt convinced that the person was dead when a sudden upheaval of the chest showed that life remained, and when the last respiration had occurred I have continued to watch for another. During the period of coma, frothy fluid may exude from the nose and mouth, and a bunch of lathery froth may be observed around the nostrils after death.

Opium poisoning does not always end in slow asphyxia as above described, in some cases, death occurs almost suddenly; while the patient is apparently going on well, the respiration rapidly fails, and death takes place within a few minutes. The following case observed while Resident Physician of the Medical College may be quoted:—An elderly man, who had been under treatment for opium poisoning for 36 hours, and had regained consciousness, and was apparently nearly convalescent, was being led about the ward by two servants, when suddenly his legs seemed to give under him, he would have fallen, had the servants not been holding his arms, he was placed on his bed, stimulants were given, the battery applied, but notwithstanding every effort, the respiration failed rapidly, and he died in less than half an hour.

In another case death occurred more suddenly and apparently from heart failure. A medical man was brought to Hospital about 5 A.M. in an unconscious condition ; the account given by the friends was vague, the stomach was washed out and there was a strong odour of opium from the washings. The usual treatment was adopted, and on the following night he became conscious, spoke, asked what treatment had been adopted, and declared his satisfaction with what had been done. After about half an hour, he relapsed into a state of unconsciousness ; when I visited him again at 6 A.M. he was unconscious, but could be partly roused by stimulation, the pulse was good, and the respirations, though somewhat slow, were strong and not stertorous, the pupils were contracted. At 10 A.M. I was suddenly sent for by the students in charge, and found the patient in a dying state; he expired within a few minutes. The students reported that the patient's condition suddenly changed, they noticed pallor of the face, the pulse became very weak. When I arrived it was imperceptible, apparently there was sudden failure of the heart.

The above case illustrates another feature of opium poisoning, one which in my experience is not very rare, namely, a temporary return of consciousness lasting for a short time, seldom longer than half an hour, followed by a relapse into the comatose condition, and death. The following is another instance :—A young man was brought to Hospital at 10 A. M. unconscious, he was treated and regained consciousness, made a statement of having taken opium, a little later he became comatose and died at 3-15 P. M. Other instances could be quoted. The explanation of the occurrence is probably that the portion of opium absorbed produced coma and a cessation of absorption, later on as it was eliminated, the coma disappeared and consciousness returned, but at the same time absorption recommenced, and the patient again sank into a comatose state.

As is the case with other poisons, opium sometimes produces unusual symptoms, the following is a striking example :—A young woman was brought to Hospital comatose, the pulse was small and quick, 120 per minute, the respiration was laboured, 25 per minute, there were tonic spasms ; death occurred not long after admission.

In some cases, vomiting takes place; in several of the cases examined by me, the police report states, the patient complained of giddiness and sickness and vomited, and then laid down and went to sleep; the attention of friends being drawn to him by the noisy character of his breathing they awakened him with difficulty, and he told them he had taken opium.

Diarrhœa is reported to have occurred in some cases. Convulsions are said to be frequently seen in children suffering from opium poisoning, they are not mentioned as having occurred in any of the 8 children whose bodies were examined in the morgue, and I do not recollect seeing this symptom in any of the cases treated in the Medical College Hospital while I was Resident Physician. The presence of alcohol is said to delay the onset and to modify the symptoms of opium poisoning. I have not observed any difference in the symptoms, the presence of alcohol was not suspected until the odour was noticed in the fluid removed from the stomach, except when information was received from the friends.

Fatal dose.—In adults the smallest fatal dose recorded is four grains of opium, this refers to the opium of the British Pharmacopœia, which contains about double as much morphine as Indian opium, and is probably three or four times as poisonous as the common bazaar opium. One grain of morphine has proved fatal.

The action of opium is modified by various circumstances, of which the chief are, age, habit, idiosyncracy, and the presence of disease. Infants and young children generally exhibit an extreme sensibility to the drug; a drop of laudanum has caused death of an infant, seven days old, in 18 hours; in another instance reported in *The Lancet*, an infant, 3 days old, died from a minim and a half of laudanum; a child, 9 months old, died from 4 drops. Taylor quotes a case of a child, four months old, who suffered from stupor and other severe symptoms after one grain of Dover's Powder.

The influence of habit in modifying the effects of opium is constantly seen in this country. Habitual opium eaters take large quantities of the drug, without any poisonous effects being produced, only sensations of exhilaration and stimulation being experienced. Some individuals have acquired the habit of taking enormous quantities. De Quincy drank 9 ounces of laudanum daily.

Dr. Golding Bird relates the case of a lady who took 10 grains of acetate of morphia, three times a day, for two years without any ill effect. In India, a very large number of persons take opium daily, and, as a rule, with benefit, certainly without any apparent bad effect; the majority continue to take the same quantity for years; some increase the amount from time to time; and a few take the drug to excess with results prejudicial to their health, dyspepsia, diarrhœa, and emaciation are the usual manifestations of excess. It may be pointed out that one frequently meets with emaciated individuals suffering from chronic diarrhœa or dysentery, and on inquiry learns they are opium eaters, it would, generally, be erroneous to attribute their condition to opium eating, further inquiry will in most cases elicit the fact that the opium was resorted to in consequence of disease.

IDIOSYNCRACY.—Occasionally a marked insensibility to the action of opium is observed in persons unaccustomed to its use. Christison mentions an instance of "a gentleman of his acquaintance, who though not accustomed to its use, has taken 450 drops of the best laudanum without any other effect than some headache and constipation; and singularly enough, his son, at the age of six, took 60 minims of solution muriate of morphine without any apparent effect."

In other persons, we may meet with extreme sensibility, an ordinary medicinal dose producing alarming symptoms.

Disease influences the action of opium; in painful affections, in dysentery, diarrhœa, inflammatory conditions, and fevers, large quantities are taken without untoward effects; but in kidney disease, opium is badly borne, and poisoning may result from a small quantity.

MODE OF ADMINISTRATION.—In this country the crude drug is generally used; morphine and the pharmacopœial preparations seldom. The usual mode of administration is in the form of pill, or mixed with mustard oil, a very common method in Calcutta; the presence of the oil increases the difficulty of removing the drug from the stomach.

Fatal poisoning has resulted from the local application of opium and morphine. Taylor mentions a case of a woman who became quickly comatose and died in 10 hours from the application of 30 grains of morphine to an ulcer of the breast. Death has been caused by a poultice made with laudanum applied to the stomach. A child, aged 1½ years, died from 5 minims of laudanum injected into the rectum. Chevers mentions a non-fatal case of poisoning due to the stuffing of a wound with opium. The introduction of opium into the vagina would cause poisoning, and Lyon states he is informed, it is a not uncommon method of attempting suicide in some parts of India. The hypodermic administration of morphine has proved fatal ; in one case, a grain and a half caused death in a few hours, the patient was suffering from pleurisy with excessive pain on the affected side.

THE DURATION OF OPIUM POISONING.—Death has occurred in 45 minutes, this is the shortest period on record. The usual duration is under 12 hours; from the Police reports of the cases sent to the morgue and my experience at the Medical College, I consider fully half the cases in Calcutta prove fatal in 6 to 8 hours, some in less. Death may not take place for one, two, three, or four days. On a previous page reference was made to two cases under treatment for 36 and 28 hours, and in which from the administration of the poison to death, probably not less than 40 hours elapsed. The following is a brief account of another instance :—A European man was found lying on the maidan asleep, when roused and questioned he stated that on the previous evening he had taken opium. He was removed to Hospital at 9-15 A.M., he was conscious on admission and made the same statement. The usual treatment was adopted, but he gradually became drowsy, sank into coma, and died on the following day, at 2-30 P. M. A post-mortem examination was held 18 hours after death, there was no sign of opium in the stomach, and no poison was found in the viscera on chemical analysis, but there was a marked quantity of opium in the washings of the stomach. Both the kidneys were pale, and there were small cysts in the left ; it is possible that the fatal result was in part due to the state of the kidneys.

PROGNOSIS.—In India, the prognosis in opium poisoning is bad, more unfavourable than Hospital statistics indicate ; many of the quickly fatal cases die before the friends realize the necessity, or make up their minds, to remove the patient to Hospital. Treatment is often greatly delayed ; in the police reports, it is constantly mentioned that a medical man was called in and recommended removal to Hospital without attempting to treat the case; the result is, very frequently, by the time the individual reaches Hospital he is in a moribund state.

POST-MORTEM APPEARANCES.—These are not characteristic; opium causes death by asphyxia and the post-morten appearances are those of this mode of death. If death has occurred slowly with a prolonged third stage of asphyxia, the dark fluid blood, the distended right side of the heart and venous system, the engorged lungs, full of blood and serous exudation, the bronchi and trachea filled with frothy fluid, are extremely well marked. In many cases, as the statistics previously given show, opium is present in the stomach, and not infrequently also, in the small intestine; the odour of opium may be observed when no particles of the drug are visible. The mucous membrane of the stomach is generally healthy, it may be congested, and not infrequently small extravastaions of blood are found at the cardiac end, due to the stomach tube.

Rigor mortis occurs as in death from other causes, its onset, development, and duration present no peculiar features.

TREATMENT.—The first indication is to remove the poison from the stomach as soon as possible. If the patient is conscious, or can be sufficiently roused to swallow, an emetic should be given, followed by copious draughts of warm water. If no emetic is at hand, vomiting may be induced by irritating the fauces; a feather is useless for this purpose in opium poisoning, the fingers pushed well back and energetically used, will, as a rule, prove effectual. The vomiting must be kept up for some time; it is extremely difficult to empty the stomach completely, and portion of the poison may remain, even after profuse emesis. The emetics commonly used are sulphate of zinc, grs. 30, ammonium carbonate, grs. 30, mustard a tablespoonful, apomorphine gr. $\frac{1}{10}$ hypodermically. The emetics should be given in cup of warm water.

If the patient is unconscious, or if satisfactory vomiting cannot be induced, the stomach pump must be used. Unfortunately, it is not a very effectual means of emptying the stomach, the calibre of the tube is too small to admit the passage of masses of opium of the size commonly taken in India. Still it must be used, and washing continued until the water returns quite clear.

For some years, the treatment of opium poisoning by permanganate of potassium has been strongly advocated. The object in view is to utilize the known action of the permanganate on morphine, which it decomposes. The treatment has been carried out in the Calcutta Hospitals for some years with, so far as I can judge, no beneficial results. The stomach having been emptied, is washed with a solution of permanganate of potassium until the fluid returns unchanged, then a quantity of a stronger solution is injected, and left in. At one time, the permanganate was also used hypodermically, I found in these cases a mass of black matter in the tissues at the site of the injection. That a solution of permanganate of potassium has the effect of decomposing morphine has been proved by laboratory experiments, but in poisoning in man, this result is not attained, as is amply proved by the experience of the Calcutta Hospitals, where the treatment has been fully carried out.

The second indication is to antagonise the action of the poison absorbed into the system. Many antidotes for opium have been extolled ; at one time, all the cases of opium poisoning admitted to the Medical College Hospital were treated with atropine, the results were not better, on the whole, than those obtained previously. In carrying out the treatment, atropine must be given freely, the effect on the respiration being the guide, dilatation of the pupil occurs after a very small dose, and is an indication of no value. The effect of an injection of even five minims of liquor atropine is often very marked, the respirations which had been four or five per minute are increased to 10 or 12 within a short time. The effect is not permanent and the injection must be repeated usually in a larger dose, and after a time in spite of the free use of atropine the breathing fails and the patient dies. Atropine is probably of use in those cases in which the quantity of opium is only just sufficient to kill, and by stimulating the respiration, the patient is kept alive a few hours, during which elimination of the poison takes place. The atropine treatment is not free from danger, sudden failure of the heart was noticed in cases in which large quantities had been used.

The third indication is to support and stimulate the patient, and to prevent him falling into the state of stupor. Coffee is one of the best stimulants and should be given freely. Strychnine is also of great use and may be given by hypodermic injection. Cold douches, flicking with wet towels, the use of the battery are the means commonly used to keep the patient awake. When the breathing begins to fail artificial respiration should be adopted and carried on systematically for hours, it is probably the best means of overcoming the tendency to respiratory paralysis.

The nourishment of the patient is most important and should not be overlooked. The bowels may be emptied by a quick acting purgative. If the bowels can be moved the opium which has passed on from the stomach will be got rid of.

Cyanogen Compounds.

Hydrocyanic acid or prussic acid is one of the most powerful poisons ; in its ordinary form it is diluted, the dilute hydrocyanic acid of the pharmacopœia contains two per cent. of the anhydrous acid, the acid known as Scheele's, four per cent.

The Symptoms, as with all poisons, are modified by the dose, condition of the stomach, and resisting power of the individual. As a rule, the onset of the symptoms is not delayed more than a minute or two ; it may be immediate, in the act of swallowing the poison, and death may occur within a few seconds. When the symptoms are delayed, the individual may perform various acts ; in a case recorded by Luff, a woman took the equivalent of 2½ grains of the anhydrous acid, she was able to rush upstairs, and tell her master who was a doctor, before she fell insensible. She was treated at once, the stomach pump was used, and other means adopted, recovery took place.

In fatal cases death occurs generally within a few minutes ; if the patient survives half an hour, there is a good prospect of recovery. The longest duration of a fatal case hitherto recorded is an hour and a half, but in a case, which I examined, the time from the first discovery of the patient to his death was not less than two and a half hours.

The symptoms begin with giddiness and a feeling of warmth, the patient quickly falls down insensible, sometimes convulsed, foaming from the mouth, the condition resembling an epileptic fit. There may be a spasmodic cry, the patient gasps a few times, and becomes insensible. The eyes are open and staring, the pupils widely dilated, the breathing may be stertorous, the pulse is very weak, rapid, irregular. Vomiting may occur; urine and fæces may be voided involuntarily during the convulsions.

When a large quantity of the poison has been taken, the individual falls insensible, and dies within a few seconds; there is no time for the development of symptoms.

FATAL DOSE.—Half a drachm of the dilute hydrocyanic acid of the pharmacopœia has caused death; recovery has taken place after two drachms.

THE POST-MORTEM APPEARANCES.—The face has, generally, a cyanosed appearance, the lips blue, the veins of the neck distended. The pupils, though dilated during life, are found of medium size at the time of the examination. On opening the body, or even before, especially if there is froth about the mouth and nostrils, the odour of hydrocyanic acid is apparent. It may be very strong; in one case, on opening the abdomen, the odour was so powerful that I felt giddy, and seemed immediately to lose the sense of smell. I could no longer detect the odour of the poison, and during the remainder of the day there was a sensation somewhat of dryness in the nose. In some cases, the odour is altogether absent. The internal organs generally are congested, the blood fluid, its colour is peculiar, a damson red. Both sides of the heart usually contain blood; in some cases the left ventricle is empty. The stomach is congested, uniformly or in patches, the colour is bright; if there is much food present, the surface of stomach may be normal.

The most characteristic features of the post-mortem appearances are the odour of the poison throughout the body, and the peculiar damson red colour of the blood.

The following case presents some unusual features:—A young man returned to his home, about one o'clock in the afternoon, under the influence of liquor; he took a pillow and laid down on the floor of his room, after barring the door from the inside. A few minutes later, his wife heard him groaning, and managed to open the door. She saw her husband convulsed and foaming from the mouth. She raised an alarm, some friends and neighbours came, they spoke to the man. He told them he had taken opium while under the influence of liquor. After some delay a carriage was obtained and he was put into it, but died before reaching hospital. From the time the wife heard the deceased groaning to his death was not less than two and a half hours. The witnesses, at the inquest, deposed that deceased told them he had taken opium because his creditors were worrying him ; and that he spoke and answered questions for about five minutes. The post-mortem examination was held about 15 hours after death. The appearances showed the mode of death was by asphyxia ; the blood was fluid and of a dark red colour. The stomach was acutely congested all over, the colour bright red ; the duodenum was in a similar condition. The contents of the stomach were two ounces of dark brown fluid, streaked with blood, the odour was somewhat alcoholic. There was no smell of hydrocyanic acid in any part of the body. On analysis, hydrocyanic acid was detected, no opium was found. It was never discovered when he took the poison and no bottle or glass was found in his room. It is possible that he threw the bottle out of the window.

CYANIDE OF POTASSIUM.

THE SYMPTOMS AND POST-MORTEM APPEARANCES of poisoning by this substance are similar to those of hydrocyanic acid, which is set free in the stomach when the cyanide is taken.

The following is an interesting and, I believe, unique case :— The deceased had a small shop in Lower Chitpore Road, Calcutta, in which he sold condiments, drugs and chemicals. Behind the shop, there was a small store room. He went to the shop at 8 A.M. as usual; about noon, as he had not returned home for his food, his cousin came to call him, and not seeing him in the shop, asked the shopkeeper next door if he had seen deceased going out. He was told that the deceased had not gone out. The cousin and a negihbour looked into the store room, over the entrance of which they noticed a shawl, and saw the deceased hanging by a rope round his neck, fastened above to a hook in a beam. The police were informed ; they came, cut down the body, and sent it to the morgue. The post-mortem examination was held on the following morning. The tongue was protruding, caught between the teeth, and cyanosed. On the protruding portion, on the chin, and down the front of the chest, there was a white chalky substance. The tips of the fingers of both hands were smeared with the same matter. Round the neck, there was running noose of rope, and a corresponding furrow on the neck. When the body was opened, the odour of hydrocyanic acid was perceived, the lungs were very congested, the blood fluid and of a damson red colour. The stomach contained two ounces of fluid and a large quantity of chalky substance, the mucous membrane was slightly corroded; the first part of duodenum was in a similar condition, and lower down there was congestion. There was a considerable quantity of the chalky substance in the duodenum and upper portion of the small intestine. The odour of hydrocyanic acid was very strong in the stomach and intestine. The tongue was slightly corroded; the œsophagus was congested. There was chalky substance on the tongue, in the pharynx, and in the trachea and bronchi which were congested.

I went to the shop with the Superintendent of Police, and saw the place where the deceased had been found hanging. Against the backwall of the store room, there was a ladder, above it, the hook to which the rope had been fastened; on either side, there were shelves. I directed the police to search for a bottle or vessel. Candles were brought, and on a shelf, close to the ladder, a brass *lotah* was discovered. It contained a little greenish fluid, the outside was smeared with chalky material. There was no odour of hydrocyanic acid from the *lotah*. In the shop, there were bottles of cyanide of potassium, besides other poisons. From the large quantity of cyanide taken, it is evident that the deceased must have made all preparations for hanging himself, and when stonding on the ladder, with the noose round his neck, drank the poison, and had time to put the *lotah* on the shelf.

FATAL DOSE.—Three or four grains.

THE TREATMENT of poisoning by hydrocyanic acid is generally of no avail. If the patient is seen immediately after taking the poison, the stomach should be emptied by an emetic, or the stomach pump; artificial respiration, cold affusion, stimulants, electricity, may be used. A mixture of proto and persulphate of iron and a little liquor potassæ may be given with the object of forming ferrocyanide of potassium.

Hydrocyanic acid is found in the leaves and especially in the kernels of a large number of plants ; cherry laurel water contains about a quarter per cent. Oil of bitter almonds is very poisonous, it may contain from 10 to 15 per cent. of hydrocyanic acid ; 17 minims proved fatal.

ALCOHOL.

Poisoning by alcohol is not common in Calcutta. During eight years, in only a few of the cases in which alcohol was found in the stomach, could death be attributed to it. In nearly all the cases, the deceased exhibited diseased conditions sufficient to account for death.

THE SYMPTOMS caused by a poisonous quantity of alcohol are —a short period of excitement, which quickly changes into stupor, deepening into coma, the breathing becomes stertorous, the face may be flushed, the odour of alcohol is noticed from the breath. The coma deepens, the pupils become widely dilated, the respiration fails and death occurs by asphyxia.

THE POST-MORTEM APPEARANCES are not characteristic, the blood is dark and fluid, the odour of alcohol may be noticed in the blood of the lungs and on opening the skull ; the stomach may be congested, or the mucous membrane may be pale, the contents smell of alcohol.

The treatment consists in the removal of the poison from the stomach, by emetics, or the stomach pump, cold affusion, artificial respiration, electricity ; coffee, strychnine, and similar stimulants.

CHLOROFORM.

Chloroform taken by the mouth produces local irritation, an intense burning sensation in the mouth, throat, and stomach ; vomiting is caused, the vomit may be tinged with blood. As the poison is absorbed narcotic effects are produced. The patient becomes gradually insensible, passes into a state of coma, which may end fatally.

FATAL DOSE.—half an ounce swallowed.

TREATMENT.—Evacuation of the stomach ; generally the stomach pump must be used as emetics do not act. Stimulants, artificial respiration, cold affusion.

THE POST-MORTEM APPEARANCES.—The mouth, throat, and stomach may be intensely congested from the local irritant action. The internal appearances are those of death by asphyxia.

CHLORAL HYDRATE.

The symptoms are similar to those caused by chloroform, but unless concentrated, the poison does not cause marked local irritation. Drowsiness is followed by deep sleep, passing into coma. The respiration is slow and stertorous, the skin is cold, the temperature, in fatal cases, falls rapidly before death.

FATAL DOSE.—10 grains have killed. Death may take place in a short time, or more usually in six or eight hours. The action of chloral is very uncertain.

THE POST-MORTEM APPEARANCES are not characteristic. In one case I found the stomach, which contained a large quantity of food, generally congested, with a number of small patches of intense congestion.

The treatment is the same as for poisoning by chloroform.

KEROSINE OIL.

Cases of poisoning with Kerosine Oil in children are not uncommon in Calcutta. The symptoms are drowsiness, insensibility, coma ; death may occur rapidly.

THE POST-MORTEM APPEARANCES are not characteristic, the odour of kerosine oil may be apparent in the stomach and throughout the body.

TREATMENT.—Evacuation of the stomach, stimulants, artificial respiration.

CARBON DI-OXIDE, OR CARBONIC ACID GAS.

Poisoning by this gas occurs in mines, wells, brick and lime kilns, ship's holds, and in other confined insufficiently ventilated places. The atmosphere normally contains from 2 to 4 parts of carbon di-oxide per ten thousand, if the amount is increased to one part per thousand, the air is injurious, one per cent. renders it poisonous ; ten per cent. is irrespirable. It is to be observed that the carbon di-oxide given off from the lungs, or generated from decomposing organic matter, is more poisonous than the gas made from pure inorganic substances.

If the air contains an excess of carbon di-oxide, as in a crowded badly ventilated room, feelings of oppression, headache, and giddiness, are experienced, followed by drowsiness. If the quantity of poison is large, drowsiness is followed by insensibility, coma and death. The onset and rapidity of the symptoms depend on the percentage of the poison present, if high the individual is at once rendered insensible, and if not rescued, death occurs in a few minutes. Convulsions may occur, vomiting may take place.

THE POST-MORTEM APPEARANCES are those of death by asphyxia.

THE TREATMENT consists in removing the individual into pure air, artificial respiration, cold affusion, stimulants.

CARBON MON-OXIDE, CARBONIC OXIDE.

This gas is accountable for several deaths in Calcutta during the cold season. It is generated by the slow combustion of charcoal, coke, or other carbonaceous fuel. It is very poisonous, and is used as a means of suicide in France and other countries.

THE SYMPTOMS begin with a sensation of giddiness, noises in the ears, nausea, and even vomiting. The individual becomes drowsy, there is great muscular weakness, sleep comes on and passes into coma, death may be preceded by convulsions.

THE POST-MORTEM APPEARANCES are characteristic. The blood is of a cherry red colour and fluid, all the organs and tissues partake of the colour of the blood. Death occurs through asphyxia. The poison is believed to act by displacing oxygen from hæmoglobin, and forming with the latter a more stable compound, carbon mon-oxide hæmoglobin. The blood is no longer able to take oxygen to the tissues. The presence of even a small quantity of carbonic oxide is injurious, owing to its great affinity for hæmoglobin.

The following is an example of the cases met with in Calcutta:—Two men occupied a room, 7 ft. × 7ft. and about 8ft. high. It had no means of ventilation except the entrance which was not provided with a door, until the day before the men were found dead. As usual they cooked and ate their food at night, and then closed the door. In the morning, both were dead from carbon mon-oxide poisoning.

TREATMENT.—Fresh air, artificial respiration, cold affusion stimulants.

Coal gas owes its poisonous qualities to the presence of carbon mon-oxide. Water gas which is sometimes added to coal gas, is extremely poisonous, and contains a very high percentage of carbonic oxide.

SULPHURETTED HYDROGEN.

This gas is very poisonous, it is said to be instantly fatal if breathed pure. It is the principal poisonous constituent of sewer gas.

When air containing a small quantity of sulphuretted hydrogen is breathed, headache, giddiness, nausea, vomiting and diarrhœa are experienced. If a large percentage is present, the individual is overcome at once, he falls insensible, and rapidly dies.

The poison appears to act on the hæmoglobin, depriving it of its oxygen, and decomposing it.

THE POST-MORTEM APPEARANCES.—The most striking feature is the extreme rapidity of putrefaction. In a case of sewer gas poisoning examined within twelve hours of death, the epidermis was peeling off, the tissues were soft, greasy, and exhaled a very offensive odour. The blood was putrid, the internal organs were already far advanced in putrefaction.

STRYCHNINE.

Strychnine is a powerful poison, and occurs in several plants of the genus strychnos (N. O. Loganiaceæ) which also contain another alkaloid, brucine, of similar properties, but much less powerful. It is said that the effect of brucine is about one twenty-fourth of that of strychnine. In the British Pharmacopœia, the seeds of the strychnos nux vomica are officinal, and two extracts and a tincture are prepared from them. The alkaloid strychnine, which occurs in all parts of the plant, is obtained from the seeds of S. nux vomica, S. ignatii, and other species of strychnos. The bark of S. nux vomica is also in use, and fatal poisoning has occurred from its accidental substitution for kurchi bark. It has also been mistaken for angostura bark. It can be distinguished by its quilled form, whitish external surface, covered with small red dots, by its intense bitter taste, and by giving a blood red colour when nitric acid is applied to the inner surface.

SYMPTOMS.—If given in solution and on an empty stomach the symptoms may commence immediately; they usually begin within five or ten minutes, but may be delayed for an hour or more. If taken in solution, the patient experiences an intensely bitter and hot taste, during swallowing. He has a feeling of suffocation, and difficulty of breathing, a sensation of tightness about the chest and throat, and twitching of the muscles of the hands and feet. In a few minutes, tetanic convulsions take place, affecting the entire muscular system ; generally the convulsions start in the limbs, extending rapidly to the trunk, face, and jaws. The legs are stretched out, the feet arched, the arms may be extended widely, or crossed over the chest. The head is thrown back, the body arched in the position of opisthotonus. The respiratory muscles are rigid, breathing diminishes, and may cease. The face becomes livid, the countenance expresses intense anxiety, the eyes are staring, the pupils dilated widely, the mouth open. The symptoms intensify, the signs of asphyxia become more marked, the patient appears to be about to die, and he may die in the first paroxysm, but usually, after a few minutes, the muscles relax, breathing recommences, the face loses its expression of pain and appearance of cyanosis. The pupils contract to the normal size ; the pulse which during the attack was weak, irregular, or imperceptible, is restored. The patient is free of pain, but exhausted, a cold perspiration breaks out, and he may fall asleep. This period of intermission may last several minutes ; in fatal cases, the interval between the paroxysms becomes shorter, and the attacks longer and more severe. The intellect is not affected, consciousness is retained to the end. The patient is aware of the approach of a paroxysm, and calls out for help. The second and subsequent paroxysms are similar to the first. The patient may die of asphyxia, during an attack ; or in the interval, from exhaustion.

Death has occurred in the first paroxysm, immediately after the poison was taken ; in several cases, it has taken place within ten or fifteen minutes, most fatal cases have terminated within two hours ; if the patient survives beyond this time, there is a good prospect of recovery, but death has occurred after six hours and, in one case, after eighteen hours.

FATAL DOSE.—A quarter of a grain of strychnine has caused death ; extractum nucis vomicæ contains 5 per cent. of strychnine, the liquid extract 1·5 per cent, and the tincture not less than ·24 or more than ·26 per cent. The seeds contain a varying quantity of strychnine ; thirty grains of the powdered seeds administered in two doses of fifteen grains each, caused the death of a girl aged ten. (Taylor).

TREATMENT.—The stomach should be evacuated by the use of emetics, or the stomach pump. Chloroform may be required in order to introduce the tube. It may also be administered during the spasms. Tannin and charcoal may be given, they render strychnine less soluble. Chloral hydrate is recommended as the physiological antidote. In the treatment of a case of strychnine poisoning, the patient should be kept as quiet as possible, the room darkened, draughts of air should be shut off, all movements in the room avoided. Experiments on animals show that strychnine increases the excitability of the reflex centres, and diminishes the resistance of the cells of the spinal cord, so that a slight stimulus which would, in a normal cord, produce little or no effect, causes an intense universal spasm. Hence in the treatment of a case of poisoning, absolute quiet and the avoidance of everything likely to cause a spasm are of the greatest importance.

THE POST-MORTEM APPEARANCES are not characteristic. In all the cases examined by me, death took place by asphyxia.

In India, tetanus is common ; cases of idiopathic tetanus are frequently met with, and there is a possibility of confounding it with strychnine poisoning. The distinction can be made by noting that strychnine poisoning comes on suddenly after taking something, food or drink ; the symptoms increase rapidly ; the paroxysms are followed by an interval of complete relaxation. The muscles of the extremities are first affected, those of the neck and jaw last ; the case ends soon in death or recovery ; opisthotonos is common.

Chever's mentions a case of tetanus fatal in the first spasm ; a boy at the Martiniere College immediately after a dressing had been applied to a sore on his foot, was seized with tetanus, the body arched forward in an opisthotonic spasm, and the boy died immediately. A case of this description could only be distinguished from strychnine poisoning by analysis of the viscera.

ACONITE.

The aconite root met with in the Indian bazaars is generally the root of the Aconitum Ferox, of which there are three subspecies and many varieties. It is imported from Sikkim, Nepal, and the countries bordering the northern frontier of India. No variety of aconite grows in the plains of India, nor in the mountains of the central and southern parts of the country. The whole of the aconite used in India is imported. It is a remarkable fact that the root is obtainable in the drug shops throughout the country; moreover, there is a general knowledge of its poisonous qualities.

Aconite root is very extensively used in native medical practice, especially in the treatment of fevers. It is also employed criminally, it comes next to, but long after, arsenic, as a means of murder by poison; cases of suicidal and of accidental poisoning are also not infrequently met with.

The poisonous effects of Aconitum Ferox are due to the presence of an alkaloid, pseudo-aconitine, which resembles aconitine, the active principle of aconitum napellus, but is said to be even more powerful.

SYMPTOMS OF POISONING.—Soon after swallowing a poisonous dose of aconite, a sensation of tingling is experienced in the lips, mouth and throat, followed by numbness. In a very short time, nausea and pain in the stomach come on. Vomiting takes place, purging also generally occurs. The patient complains of giddiness, there is great muscular weakness. Sensations of tingling and numbness may be experienced over the whole of the body, also twitching of the muscles. Swallowing becomes difficult, or impossible, the voice is lost, vision is impaired. The body is bathed in cold perspiration. Respiration is greatly enfeebled; the heart's action is weak and irregular. The heart and respiration become slower, and death takes place, generally, by asphyxia. As a rule, the mind is not affected, but in some cases delirium has been observed.

Death has occurred within eight minutes after taking aconitine.

In poisoning by aconite root, death usually occurs in two or three hours, or it may be delayed for several hours, and in one reported case, it occurred at the end of four days.

FATAL DOSE.—One-sixteenth of a grain of aconitine has caused death; as pseudo-aconitine is more active, a smaller quantity of it would probably prove fatal. Nine minims of linimentum aconiti, twenty-five drops of tincture, and four grains of an extract, have caused death.

It appears that the root varies much in alkaloidal strength. Chevers mentions a case in which fifteen grains of Indian aconite root, probably aconitum ferox, gave rise to severe symptoms.

THE POST-MORTEM APPEARANCES are not characteristic. The mucous membrane of the stomach is congested in most cases. The state of the heart, and the distribution of the blood indicates death by asphyxia. Of four cases examined by me, in three the stomach was congested, in one it was pale. The duration of these cases varied from an hour and a half to four hours. In all vomiting was a marked symptom.

TREATMENT.—Evacuation of the stomach either by emetics, or the stomach pump. Tannic acid or animal charcoal may be given. Stimulants should be freely administered, tincture of digitalis, nux-vomica, ammonia are of most use; digitalis has been given hypodermically with success.

Besides the poisonous varieties, there are several non-poisonous aconites met with in India, and used as tonics and anti-periodics. Of the non-poisonous varieties, the Aconitum Heterophyllum is the most common; Aconitum Palmatum is also met with. Both are called "atis," though the name is properly applied only to the A. Heterophyllum. The A. Palmatum is also known as "Bikhma or bishma."

As found in the bazaars the root of A. Heterophyllum is about one to one and a half inches long, about half an inch thick at its upper extremity. It is a tapering root, like a small carrot, smooth and white when fresh, and breaks with a starchy fracture, the surface having uniform milky white colour. When old and dried, it is shrivelled and warty. The root of the A. Palmatum generally occurs, in fragments, one to three inches long, about a quarter of an inch thick, white and of a starchy consistence.

The principal poisonous variety of aconite found in the bazaars is the root of the A. Ferox. The specimens generally obtained are from an inch to an inch and a half long, dark brown, hard, conical or carrot-shaped, shrivelled longitudinally. The cut surface has a mottled appearance, due to the presence of darker masses imbedded in the tissue.

Sometimes the roots are soaked in cow's urine for a time, and then dried ; these roots are darker in colour, tough, surface smooth, or only slightly shrivelled. If completely dried, they are brittle, and have a reddish brown resinous appearance on section.

The non-poisonous aconites have a bitter taste ; those belonging to the poisonous varieties produce tingling and numbness when chewed.

DATURA.

Datura alba and Datura fastuosa are common in India ; the seeds and, to a less extent, the leaves, are used. They contain an alkaloid, daturine, isomeric with atropine, which it also resembles in chemical properties and physiological effects.

Poisoning by Datura is common in India ; in most of the cases, the drug is administered with the object of producing unconsciousness to facilitate robbery. It is also used as an intoxicant. The administration of stupefying drugs to facilitate theft is a common crime in this country, and the drug almost always selected is datura. There is a general but erroneous belief that it causes insensibility only and not death, which probably accounts for its use in theft cases.

The seeds, whole or, more often, pounded are generally employed, and are administered in food or sometimes in liquor. The leaves are, in some cases, mixed with tobacco and smoked, the result is rapid loss of consciousness ; seeds are also used in this manner.

SYMPTOMS.—When the drug is given in food, the symptoms may come on immediately, and the victim is rendered helpless at once. The following is a typical instance :—A woman, who had been visited by two men for two or three evenings, stated that on the last occasion her food was brought into the room where she and the men were ; she had to leave the room for a few minutes, on her return she began to eat her food but, after taking a little, found that it was bitter, and took no more. She had no recollection of what occurred after that, and when she came to her senses, was astonished to find herself in the Medical College Hospital. The evidence of one of the other prostitutes living in the house was, that she happened to go into the woman's room and found her insensible. An alarm was raised, the police came, and had the woman removed to hospital. The men had decamped, they were arrested some months later, tried and convicted.

In another case, a man stated that when travelling by train to Calcutta, a fellow passenger with whom he had had a friendly talk, gave him the hooka to smoke ; after a few puffs he found himself becoming giddy, his vision was blurred, his mouth dry, his senses seemed to be leaving him, he felt powerless ; just at that moment, the train pulled up at a station, and he was able to open the door, and call out. His fellow passenger got out hurriedly, and disappeared. The symptoms passed off in a short time. In another case, a youth arrived in Howrah station, by the Punjab Mail, he behaved in a boisterous, insane manner at the station, and was taken charge of by the police, and placed before a magistrate, who finding him apparently insane, remanded him to jail for observation. On admission, he was boisterous, incoherent, pupils dilated ; on the following morning, he was still somewhat excited. In forty-eight hours, he was in his right senses, and after a good dealing of questioning, confessed that a friend had given him a hooka containing datura, which he had never previously smoked.

In other cases, an interval of about half an hour, or longer occurs before the symptoms begin. There is a period, generally of some hours, during which the patient is delirious, talking loudly and incoherently. There is a sensation of dryness of the throat, the mucous membrane is congested, the voice hoarse, the pupils widely dilated, the eyes congested. The skin is hot and dry, there may be a red rash on it ; the pulse and respiration are rapid. The patient reels and stumbles when he attempts to walk. He is restless, talks and shouts. The delirium is peculiar, generally, of a pleasing character, he laughs, shouts, tries to seize imaginary objects. He goes through the movements of drawing threads from his fingers. Looking intently at the fingers of one hand, with those of the other, he appears to seize and pull out a long thread. These motions are repeated again and again. The patient is timid, and when most boisterous is easily controlled. Sometimes he jumps up and tries to rush from the room to escape some imaginary danger. After a time the delirium subsides, he sinks into a condition of stupor which may pass into coma, ending in death, or more often, the comatose symptoms disappear and recovery takes place. The pupils remain dilated for some days, and the patient may not regain his normal mental condition for some time. In some cases, after the coma has passed off, a stage of secondary delirium lasting several hours occurs.

In fatal cases, the duration generally extends to several hours; in one case examined by me, the history given by the police pointed to a duration of twenty-nine hours; ten to twelve hours seems to be the average. Death may take place sooner. In poisoning by Belladonna, the active principle of which is similar to daturine, death has occurred in two hours, and in one case is said to have taken place in five minutes, after a hypodermic injection of atropine.

Fatal dose.—This cannot be stated with certainty, probably one hundred seeds of the D. alba, or less than that number of those of the D. fastuosa, which are nearly double the size.

The Prognosis is generally favourable. Of cases that are treated early, the majority recover.

In the paper by Evans and Bose previously referred to, an account is given of a case in which datura was administered to facilitate murder by violence. A woman mixed a whole Datura fruit in the curry which she prepared for her husband. When he became unconscious she killed him with a dao.

In the same paper reference is made to the administration of datura to effect destruction of the intellect. It is said that the crime is carried out secretly and very gradually, so as to simulate the natural course of mental disease. It is stated that wives administer datura to their husbands in order to obtain opportunity to carry on intrigues, and that prospective heirs to large properties are by the same means deprived of reason by individuals interested in the succession, as under Hindu law insanity is a bar to inheritance.

TREATMENT.—The stomach should be emptied by emetics or the stomach-pump; morphine may be given to allay excitement, but it is better to avoid its use and to treat the patient on general principles, stimulants, cold affusion, artificial respiration. Pilocarpine has been highly recommended. Elimination takes place principally through the kidneys; the bladder should be emptied to avoid risk of reabsorption.

THE POST-MORTEM APPEARANCES are indefinite, congestion of the throat and stomach may be present, and if the examination is made soon after death, the pupils may be dilated. The brain is highly congested.

BELLADONNA.

Atropine, the active principle of Belladonna, exists in all parts of the plant. It is an extremely powerful poison; cases of poisoning by Belladonna are not very uncommon, they are generally accidental, due to mistakes in dispensing, or in the use of medicinal preparations; suicidal cases also occur.

THE SYMPTOMS are similar to those of datura poisoning. In a case, which I saw recently, the result of taking the liniment of Belladonna, the patient was in a comatose condition for several hours, and when the coma passed off, he was delirious for a time. In fatal cases, the coma becomes profound, and death follows. The PROGNOSIS is generally good.

FATAL DOSE.—One-thirtieth of a grain of atropine, given by hypodermic injection, has proved fatal, one-twelvth of a grain by the mouth has caused death. An enema of extract of Belladonna estimated to contain one-sixth of a grain of atropine, has killed. Recovery has taken place after as much as four grains. The application of atropine to a blistered surface caused death.

THE TREATMENT is the same as in datura poisoning.

CANNABIS SATIVA.

Cannabis Sativa, or Cannabis Indica, or Indian hemp, is much used in all parts of India as a stimulant and intoxicant.

The preparations in common use are :—Bhang or siddhi, composed of the dried leaves and small stalks; ganja, the flowering tops; charas, the resin which exudes from the leaves and branches. There is also a sweatmeat which contains bhang, called majum.

Bhang is taken finely powdered, mixed with spices or sugar; or an infusion is made with cold water, strained, sweetened with sugar, and drunk like tea. Bhang is also taken in the form of a large pill or bolus, and it may be added to pan and chewed.

Ganja is smoked, mixed with tobacco; sometimes datura is added to increase the intoxicating effect.

Charas is also smoked with tobacco, its use does not appear to be so common as that of bhang and ganja.

Indian hemp is held in high estimation as a pleasant stimulant and aphrodisiac; it is much used for the latter quality, which, apparently, it possesses to some extent.

When taken in sufficient quantity, Indian hemp, in any form, produces a condition of intoxication. The individual is excited, the senses are stimulated, he is emotional, laughing and singing, pleased with everything. This state may alternate with fits of maudlin depression. The imagination is stimulated, hallucinations are produced; the character of the hallucinations appears to be governed by the nature of the subject towards which the thoughts are usually directed. Thus, the sensualist has visions of a sensual description; the ascetic finds his powers of contemplation are increased by a dose of hemp. Major Prain, who investigated the cultivation and use of Indian hemp, has written a full report on the subject.

Individuals in the habit of using bhang or ganja know the quantity required to throw them into a trance-like condition, during which they experience visions of the most pleasing kind. After a time, narcotic effects are produced and the individual falls asleep for an hour or two.

In some cases, probably, mostly persons unaccustomed to the drug and who took too large a dose, there is marked delirium, the individual is violent, even maniacal, for some hours, then sinks into a condition of stupor which may end in fatal coma, or more often, after a duration of several hours recovery takes place gradually.

Death is very seldom caused by Indian hemp. In many of the reported cases, it is probable that datura was also present. The following case is the only instance of fatal poisoning by bhang that I have met with; so far as could be ascertained, the deceased took no other drug:—A young sepoy went with some companions to the city of Lucknow, where they all indulged in bhang. That night the deceased was brought to hospital in a state of violent delirium. He sang, shouted, tried to rush out of the room and struggled violently with the attendants. His face was flushed, his eyes red, his expression wild. Next morning he was quieter, but still delirious. By the second day he had regained his senses completely; in the afternoon, being no longer closely watched, he slipped out of the hospital, and was absent for two or three hours. When he returned, he appeared to be quite well, but some hours later, he was again very delirious and violent; these symptoms increased for some hours, he then sank into a condition of stupor, which passed into coma, and death took place in the morning.

A post-mortem examination was held; the stomach contained a large quantity of coarsely powdered bhang, there was also a considerable amount in the small intestine. The internal organs generally were very congested. There was acute general meningitis with a large sero-purulent exudation, most marked over the upper part of the brain. The substance of the brain was very congested.

FATAL DOSE, unknown.

TREATMENT.—Evacuation of the stomach, cold affusion, a rapidly acting purgative.

Except the case mentioned, I have not had the opportunity of making a post-mortem examination in poisoning by Indian hemp. It is probable that, as a rule, only general congestion would be found.

The connection between hemp drugs and insanity has been much discussed and opinions differ greatly. Many medical men hold that, in India, a considerable number of cases of insanity are caused by the habit of taking bhang, or of smoking ganja. Others deny all causative relation between hemp and insanity in any form, except temporary intoxication which may last several days or even longer. There is a widespread popular belief that ganja or, less often, bhang is the commonest cause of insanity, and in the form, which is filled up by the police when an individual suspected to be insane is placed under medical observation, the question regarding the supposed cause of the disease was almost invariably answered by the words "addicted to ganja." Since the form was altered, and directions given that when the answer to a question is unknown, the fact is to be stated, the police no longer feel bound to enter a supposed cause. In the few instances, out of the large number of cases of alleged insanity placed under observation, in which I had the opportunity of sifting the evidence regarding ganja, I found the statements of friends and others extremely vague, and quite insufficient to establish any causative connection between the drug and the disease.

The subject has been ably discussed by Surgeon-Captain J. H. Tull Walsh in an interesting paper which he contributed to the Journal of Mental Science, for January 1894. After going fully into the evidence, Surgeon-Captain Walsh formulates the following conclusions :—" 1. That hemp drugs are very largely used in Bengal, smoked as ganja and charrus ; drunk as bhang and siddhi, or eaten as majum. The smoking of charrus and the eating of majum are not very common."

" 2. Among healthy persons ganja smoked alone, with tobacco, or with a very small addition of datura (two or three seeds) produces a condition varying from mild exhilaration to marked intoxication. The violent intoxicating effects are less marked, or not seen at all, in persons having a regular and wholesome supply of food. (Ext. 21). Much the same may be said of bhang, etc."

" 3. Among persons of weak mind, or with a marked neurotic tendency, even a moderate quantity, or only a slight excess of hemp drugs, may so increase the insanity, evident or latent, as to make such persons violent, morose, or melancholy, according to the neuropathy with which we start. The presence of adulterations, such as datura will increase these effects."

" 4. Abuse of hemp drugs, especially when adulterated with datura, will produce even in healthy persons a very violent intoxication simulating mania, or may lead to a morose melancholic condition, or to dementia. These conditions are generally of short duration, and the patient ultimately recovers. So common is absolute recovery that I think when a patient confined in an asylum for the treatment of insanity said to be due to the abuse of hemp drugs does not recover within ten months these drugs were possibly only the exciting cause, and that we are dealing with an individual who was either insane previous to his use of intoxicating drugs, or with one in whom latent insanity has been roused into activity by the vitiating effects of excess of ganja, bhang, etc."

As to the connection between hemp drugs and crime, Surgeon-Captain Walsh quotes the views of several medical men of experience, who are of opinion that the drugs do not appear especially to arouse any homicidal or criminal propensities. No doubt thieves and murderers smoke hemp to nerve themselves for acts previously determined on. Surgeon-Captain Walsh points out that "running amok" is not common in Bengal, and where it occurs, there is nothing to show that it is in any way connected with the use of Indian hemp drugs. He also states, it is evident that Dr. Gilmore Ellis, Medical Superintendent of the Government Asylum, Singapore, does not consider the amok of the Malays to be caused by the abuse of preparations of India hemp.

NERIUM ODORUM.

Poisoning by Oleander is not very uncommon; most of the cases are accidental, due to the medicinal use of the plant which is believed to be of benefit in rheumatism and other diseases. It is also used to produce abortion. Cases of suicide and of homicide by this substance also occur.

SYMPTOMS.—Two cases of Oleander poisoning were treated in the Police Hospital, Calcutta, in November 1898. One proved fatal. The patients belonged to the Fire Brigade, and had been advised to take a decoction of Oleander root for the cure of rheumatism. They prepared a strong decoction overnight, and in the morning, each drank a cupful. Shortly after, they were seized with vomiting, and had vomited several times before admission to the hospital, at 10 A. M. The elder of the two, aged 50 years, was conscious and able to swallow on admission, and complained of no pain. He vomited a yellow, frothy fluid in the Hospital. About noon, twitchings of the hands occurred, and an hour later, there were spasms in the face and upper extremities, and to a slight degree in the legs; there was no lockjaw, but he could not swallow, nor speak. He appeared to understand what was said and smiled vacantly. The conjunctivæ were sensitive, the left pupil dilated, pulse very slow and small, about 50 per minute, respiration hurried. Later there were convulsive movements, most marked in the upper extremities, and after a time, the body became rigid. The patient was unconscious, eyes open, pupils dilated, the left more than the right. Pulse rapid 100 per minute; respiration hurried, 70 per minute. The rigidity passed off after some hours, but the general condition did not improve. The breathing was stertorous; coma became profound, and death took place about twenty-six hours after taking the poison. The other man, strong, twenty-five years of age, recovered slowly. He exhibited similar symptoms, which developed more slowly, twitching did not begin for about twelve hours, vomiting continued longer. The pulse fell to fifty beats a minute, respiration was hurried, convulsions were marked. The patient become semi-unconscious, he lost the power of swallowing. His condition was serious for some days, and he was dull and morose until the sixth day. About twenty-four hours after taking the poison convulsions were marked, the body was arched (opisthotonus).

From the washings of the stomach of both, and from the viscera of the man who died, the Chemical Examiner obtained "a narcotico-irritant principle producing vomiting, weakness of the heart, general uneasiness and drowsiness but no twitchings or convulsions."

The Post-Mortem Appearances in the fatal case, which was examined about four hours after death, were: Congestion of the internal organs generally; marked congestion of the lungs. The right side of the heart was full of fluid blood, the left side nearly empty; there were spots of subendocardial hæmorrhage in the left ventricle. The stomach was in folds, the tops of which were congested, the mucous membrane was congested, especially along the lesser curvature. The brain was healthy.

A detailed account of these two cases by Assistant Surgeon Kali Mohon Sen was published in *The Indian Medical Gazette*, April 1899.

Treatment.—Evacuation of the stomach, stimulants.

Fatal dose—Unknown. A woman committed suicide by taking three crushed seeds of yellow oleander. Death occurred in six hours.

COCAINE.

The active principle extracted from the leaves of the Erythroxylon Coca, and its varieties.

During the last few years, cocaine has been much used in Calcutta and other large cities in India, for its stimulant and aphrodisiac effects. It is used mostly in the form of the hydrochloride of cocaine, which is added to pân and chewed. Before efforts were made to put a stop to the use of the drug, pânwallahs were in the habit of selling for three pice a pân containing about half a grain of cocaine. At this price, the sale gave them a profit of about 50 per cent.

THE SYMPTOMS of acute poisoning vary greatly. At first, there is generally, a period of excitement, pulse and respiration are increased, there is a sense of fulness and oppression in the head, there may be delirium of a noisy character. After a short time, signs of collapse appear, the pulse and respiration become weak, the patient sinks into stupor which deepens into coma, convulsions occur, and death follows. In other cases, symptoms of collapse appear from the beginning; in some persons, there is marked delirium, in others unconscionsness from the first.

In fatal cases, death has generally occurred soon, in one instance, in twenty minutes. I observed alarming symptoms from the application of a strong solution to the eye, the patient became collapsed, pulse and respiration were very weak. Under energetic treatment recovery was rapid.

FATAL DOSE.—Half a grain by hypodermic injection has caused death, but recovery has followed very large doses. It appears to he a very uncertain drug in its toxic effects; some people exhibit a great susceptibility and alarming symptoms may follow even the local application of a small quantity to the gums or conjunctiva. Other persons can take large quantities without any symptoms of poisoning being caused.

THE POST-MORTEM APPEARANCES are not characteristic.

TREATMENT.—If the poison has been swallowed, the stomach should be emptied; general stimulants, cold affusion.

COCAINE HABIT.—The powerful stimulant effects of Erythroxylon Coca have long been known to the people of Bolivia and Peru, who have been in the habit of chewing the leaves to ward off the effects of severe exertion, to diminish respiratory difficulty in ascending mountains, and to relieve hunger, thirst and fatigue. In medicine coca and its preparations are used as nervine and muscular tonics, beneficial in all conditions of debility and exhaustion. They produce a pleasant feeling of physical and mental exhilaration. Cocaine has also powerful anæsthetic effects, and is much in use to relieve pain, and as an anæsthetic in surgical operations, especially on the eye, nose, throat and ears. Patients who have had to use cocaine for any purpose, sometimes develop a craving for it, and continue using it for the pleasurable sensations which it causes. In order to produce these effects, the dose has to be continually increased, and after a time, symptoms indicative of disorder of the body and mind are produced. The patient experiences vertigo, palpitation, mental depression, and irritability, which are temporarily relieved by a dose of the drug. Gradually the mind is affected, the character is altered, the individual becomes listless, incapable of sustained effort, mental or physical, he suffers from hallucinations, visual and auditory, and from delusions of persecution. He neglects his business, and may gradually sink into a condition similar to that produced by chronic alcoholism. There is often a tendency to suicide. The craving may lead to criminal acts, to obtain the means to procure the drug.

In India, cocaine is taken for its stimulating and aphrodisiac effects, the habit is becoming common in the large towns, and no doubt, before long, instances of the evil effects produced by it will be met. Up to the present I have not come across a case of cocaine mania.

CHAPTER XX.

SEX AND SUBJECTS CONNECTED WITH THE SEXUAL RELATIONS.

Malformations.—Imperfect, or abnormal development of the genitals have caused mistakes regarding the sex of infants, and in some instances, the individual has reached adult life before the error was discovered. In most of these cases, the mistake has arisen from malformation, or unusual development, of the external genitals, a small hypospadiac penis and cleft scrotum producing an appearance simulating the female genitals ; or an enlarged clitoris being taken for a penis. There are, other, but much rarer, cases in which the organs of one sex are combined with some of the organs of the other sex ; the general appearance of the individual, the bodily configuration, may or may not correspond with the predominant sexual organs. There are manly women, androgynæ, in whom the female organs are combined with a manly type of body and, in some cases, with certain male organs. Womanly men, or androgyni, individuals of the male sex with a feminine configuration, and also occasionally with some of the female genital organs.

In a few recorded cases, individuals are said to have possessed the complete organs, including testicles and ovaries, of both sexes, true hermaphrodites Most authors deny the existence of such persons, but from the stand point of embryology, the possibility of the occurrence of a complete set of the essential organs of generation of both sexes in one individual cannot be absolutely excluded. It seems possible that the germinal ridge might give origin to the epithelium of seminiferous tubules at one part, and to Graafian follicles and ova at another. The Fallopian tubes, uterus, and vagina develop from the Müllerian duct. The vas deferens and epididymis are formed from the Wolffian duct. The tubules of the Wolffian body give rise to the parovarium in the female, and to the vasa efferentia and coni vasculosi in the male ; some of the tubules might form the rudimentary functionless parovarium, and others join the seminiferous tubules.

Though the possibility of true hermaphrodism may be conceded, the fact remains that most of the recorded cases have proved to be examples of a combination of certain organs of both sexes in one person. The determination of the sex of the individual may be extremely difficult, or quite impossible, during life, and after death, may require close scrutiny by an expert. Great skill is required to distinguish in badly developed tissue, ovary from testicle.

In cases of this kind, Lord Coke states that by English law, "an hermaphrodite may be either male or female, and shall succeed according to the kind of sex that doth prevail."

Androgynæ or manly women generally have a masculine face and figure, beard and moustache, broad shoulders, undeveloped breasts and hips, masculine voice. The uterus and ovaries may be altogether absent, or more often, they and the vagina are in an undeveloped infantile condition. The clitoris and external genitals may also be small and undeveloped, or the clitoris may be large, and the labia may contain the ovaries. The enlarged clitoris may measure three or four inches in length.

It must be pointed out that a woman exhibiting a very marked masculine appearance, voice, manner, and mental characters, may possess genitals, normal in shape and size, and functionally active ; and similarly, a man of feminine appearance and mind may have normally developed sexual organs.

The defect in males which most often gives rise to mistakes regarding sex, is a small imperforate penis, hypospadias, cleft scrotum, and undescended testicles. The diagnosis can usually be made by careful examination, which reveals the absence of labia minora, hymen, vagina, and uterus.

The cases most difficult to determine are those in which there is a combination of the organs of both sexes. Some of these cases are not suspected during life, the individual may appear normal, and may fulfil the sexual functions normally, though possessed of some of the organs of the opposite sex. The following is an example, brought before the Pathological Society by Mr. Willett, The specimens were obtained from a man, aged 44 years, married, the father of two children. His penis was well developed and he wore a beard. The testicles were undescended and lay in the abdomen in the position of ovaries, there was a well developed uterus and vagina which narrowed down below and passed through the prostate, opening in the usual site of the uterus masculinus. From the testicles, the vasa deferentia passed along the side of the vagina to the prostatic urethra. From the uterus a Fallopian tube passed on either side towards the testicle, ending in a dilatation similar to the hydatid of Morgagni.

In some cases, the external organs suggested the male sex but a periodical discharge of blood through an opening behind the scrotum showed that the individual was a female. In these doubtful cases the general appearance, voice, manner, mental character, and direction of the sexual desires, afford assistance in arriving at an opinion, but unless evidence of the existence of ovaries, or testicles can be obtained, a positive opinion cannot be given ; in some cases menstrual discharge takes the form of a vicarious hæmorrhage.

Defects of the genital organs, not of a kind to cause doubt as to the sex of the individual, may prevent the normal performance of sexual functions, and, for this reason, form the ground of an application to the court, for a decree declaring the marriage "null and void." Marriage is a contract which the court may declare "null and void" on proof that, at the time it was entered on, either of the parties was permanently and incurably incapable of sexual intercourse. But if marriage is knowingly contracted with an impotent person, or one of so advanced an age that impotence might reasonably be inferred, it cannot afterwards be set aside on that ground.

Sterility or want of procreative power is not a ground for declaring a marriage null and void, unless combined with impotence or incapacity for sexual intercourse. The refusal of either of the parties to participate in sexual intercourse, within a reasonable time after the marriage, is presumptive of impotence. If, from the nature of the defect present, sexual intercourse is possible, but only by adopting ways to which it is not reasonable to expect the party to submit, the defect would probably be considered to constitute incapacity for sexual intercourse. If impotence is due to a temporary cause and curable, the marriage is not set aside, provided the defect is cured ; but the individual may refuse to submit to the necessary treatment, in that case the impotence would be considered as of an incurable character.

IMPOTENCE OR INCAPACITY FOR SEXUAL INTERCOURSE IN THE MALE may be due to various causes; it is often combined with STERILITY and the two conditions may be considered together.

AGE.—The procreative power begins at puberty, which usually occurs at about fourteen years of age, not infrequently earlier, especially in India.

Before the occurrence of puberty, power of erection of the penis exists and intercourse is possible; that boys, long before they arrive at puberty, are capable of copulation is well known. Recently a boy, about seven or eight years old, was sent for examination, on a charge of rape, committed on a girl of about four years old. He showed no sign of puberty and a report was made to that effect. The little girl exhibited no trace of injury, the hymen was intact, but the hole in it was large, and it is possible that penetration had occurred. I have heard of an instance of a boy being a father at the age of twelve years. Cases of precocious puberty in boys have been recorded by various writers; Woodman and Tidy mention one of puberty in a boy in his second year.

The signs of puberty are development of the penis and testicles, growth of hair on the pubes and scrotum, later, on the face and other parts of the body. The voice is altered, owing to development of the larynx, and the body assumes a manly appearance. Secretion of semen takes place and sexual desires are experienced. In boys, puberty does not bring about the marked changes by which it is characterised in females; the boy does not become a man till some years after puberty, but in females, menstruation rapidly transforms the girl into a woman.

In examining a boy as to the existence of puberty, the opinion should be based on the physical characters, age is of little importance.

Sexual capacity and procreative power diminish in advanced age, but very old men have impregnated women. Casper found spermatozoa in the semen of a man of ninety-six. No age limit can be assigned to the sexual capacity and procreative power in males.

Defects of the sexual organs may cause impotence and sterility. Complete absence of the penis may be congenital or the result of injury or disease; it necessarily renders the individual impotent. Partial loss, or deformity, provided it does not prevent the deposition of the semen within the vulva, does not necessarily produce impotence or sterility. Impregnation has occurred from semen deposited within the vulva. Absence of testicles, or complete destruction of their functions, renders the individual sterile, and usually also impotent, but eunuchs may be capable of copulation, and some have been libidinous. After removal of the testicles, fruitful intercourse may occur, owing to the presence of spermatozoa in the seminal bladders. Persons with undescended and imperfectly developed testicles are often impotent, as well as sterile; erection is imperfect and ejaculation of whatever secretion there is takes place prematurely before penetration; exceptionally cryptorchids are potent and capable of procreation.

Local conditions of the penis—phymosis, stricture, epispadias and hypospadias may prevent impregnation. In cases of tight stricture situated far back, the semen, prevented from passing forward, may be forced into the bladder. In giving an opinion in any case of supposed sterility from defect or deformity of the penis, great caution is necessary.

Impotence and sterility may be caused by constitutional conditions and disease. During the course of fevers and other debilitating diseases, there is a temporary impotency. Injury, or disease of the brain, or spinal cord may prevent erection by interfering with the transmission of impulses from the central nervous system. Erection of the penis is a reflex act, normally produced by voluptuous thoughts, but also capable of being induced by peripheral irritation. Failure of erection may occur from loss of irritability of the local nerves, or of the local centre, which is probably located in the lumbar cord, or from interruption of the nerves which connect the brain with the local centre, so that the effects produced by voluptuous thoughts are not transmitted, and also from psychical causes. Nervousness and a dread of failure may prevent erection, or may lead to premature ejaculation. A man physically capable of copulation, may find himself completely impotent with regard to one woman. There are cases of wives obtaining a divorce on the ground of the impotence of the husband, who has subsequently proved potent with another woman. A few years ago, a woman, who had been married some years, sued for a decree of nullity, and at the trial, the medical experts, who had examined her, declared she was *virgo intacta* ; the husband acknowledged that he had not been able to consummate the marriage ; the suit was successful. Within a year or two, the man married again and had children. His first wife was young and attractive.

IMPOTENCE AND STERILITY IN THE FEMALE.

The procreative age in women is much more clearly defined, and of shorter duration than in men. It begins with the establishment of menstruation and continues until the menopause, which generally takes place between forty and forty-five. Puberty occurs in Europe about the age of fourteen ; in this country earlier, about the age of twelve. There are numerous recorded cases of early puberty and of early pregnancy. Menstruation has occurred in a child only four months old ; abnormal development of the genitals has been observed in children ; the genital organs of a girl of two had the appearance of those of a female of seventeen or eighteen. (Lenhossek quoted by Hofmann). Kussmaul found pregnancy in a girl of eight.

Puberty in the female is attended by more marked changes than in the male ; the breasts enlarge, the figure acquires a womanly appearance, hair appears on the pubes. The genitals, external and internal, enlarge, and a periodic sanguineous discharge takes place per vaginam, and recurs at regular monthly intervals during the reproductive period, except when interrupted by pregnancy or other causes. When puberty is reached the girl passes from childhood to womanhood in a short time.

Exceptionally ovulation continues after the cessation of the menses; not infrequently it occurs during the absence of the menstrual flow ; women, who have ceased to menstruate for several years, have become pregnant ; conception has occurred in women who have never menstruated.

In sexual intercourse, the woman is a passive agent and consequently defects which absolutely prevent impregnation are not a barrier to copulation. Complete absence of the vagina causes impotence and sterility. Intercourse may be rendered impossible by vaginismus. Absence of the uterus or ovaries renders a woman sterile. More often, barrenness is due to disease of these organs, or of the Fallopian tubes.

A rigid hymen may prevent complete intercourse, but pregnancy may result, unless the hymen is also imperforate. Deformity or abnormal smallness of the vagina may interfere with copulation, but if there is an opening, even of small size, impregnation may occur.

SIGNS OF VIRGINITY.

Under various circumstances, suits for nullity of marriage, cases of rape, defamation, divorce, and others, it may be necessary to determine whether a woman is *virgo intacta.*

In a healthy well-nourished virgin, who has arrived at puberty, the labia majora are large, firm, rounded, their edges are in contact, and the labia minora are completely hidden. The labia minora or nymphæ are two folds, covered with mucous membrane, which extend from the margin of the clitoris. They are small, soft, moist, and of a red colour. The hymen is intact; the vagina is narrow and rugose. The vestibule or space in front of the hymen is narrow.

The condition of the labia majora depends principally on the amount of subcutaneous fat in them ; in badly nourished subjects, they are small and their edges do not come in contact. In advanced age, the tissues lose their elasticity and firmness, and the vulva is patulous ; in young children, the labia are not well developed and the upper part of the vulva gapes, exposing the meatus of the urethra.

The appearance of the labia minora is largely dependent on the condition of the labia majora. If completely covered, they are soft, moist, and red, but if exposed, they become brown, and acquire the appearance of skin.

The most reliable sign of virginity is the presence of an intact hymen, but it is not an absolute proof as it may persist after repeated coitus ; it may be ruptured by other means than the male organ. It has been found intact even after delivery.

The hymen varies in shape and substance. It is generally a thin membrane, but not infrequently it is thick and fleshy. Absence of the hymen is extremely rare ; most of the cases reported by the older writers are probably the result of imperfect examination. In children especially, the hymen may easily be overlooked, it is situated deeply and can only be brought into view by separating the labia majora widely. Modern authors are agreed that congenital absence is extremely rare.

The hymen makes its appearance in the fœtus about the fifth month. It is formed by two folds, one on each side, at the opening of the genital passage into the uro-genital sinus. The folds coalesce in the middle line leaving an opening into the vagina. In children, the development from lateral folds is generally apparent. Fusion of the two sides takes place in different ways producing the various shapes of hymen met with. A common form is a diaphragm with an opening in the anterior portion. Sometimes this opening is central ; it may be circular, more often oval, or it may be a narrow slit. If the opening is large and situated in the anterior part, the hymen has a crescent shape. The margin of the orifice may be notched, producing an appearance which may be mistaken for ruptures, partly healed, but close examination will show the absence of cicatrices. The orifice may have a fimbriated edge ; occasionally it is divided by an a narrow band, bridged hymen. In some cases, the margin of the orifice is thick, forming a ring. In one case which I examined, the hymen of diaphragm shape, was tough and fleshy, the orifice of large size, was circular, its edges thick and rounded, two fingers could be introduced without causing rupture. Occasionally, the openings are multiple, producing the cribriform hymen. The hymen may be a narrow band encircling the orifice of the vagina, or crossing it antero-posteriorly. In children, the hymen is deeply placed and tough ; after puberty, it is more easily lacerated.

In a woman, who has reached puberty, the presence of an uninjured and intact hymen of the usual texture and with an orifice of the ordinary size, is the most reliable sign of virginity. It may be taken as proving that complete sexual intercourse has never occurred, but it does not exclude the occurrence of partial or vulvar penetration which is sufficient to constitute the sexual intercourse necessary to the offence of rape.

As a general rule, the hymen is lacerated in the first act of coitus ; the number and position of the tears depend on the shape and texture of the membrane. In the crescent hymen, two deep tears generally occur at the posterior part, one on either side, forming a triangular flap between them, and smaller, shallower lacerations in front. The circular diaphragm hymen is usually torn in several places, a number of small flaps being produced.

Some authors assert that lacerations of the hymen never heal ; this is a mistake, union which may be complete or incomplete, occurs if the parts are undisturbed, but if intercourse is repeated at short intervals, healing cannot take place. In the normal unstretched condition of the parts, the hymen is not a tense membrane, on the contrary, especially in children, it is flaccid and in folds ; hence if ruptured by sexual intercourse, after the act the torn edges tend to fall into apposition, and the parts being vascular, healing is accomplished in a few days, provided no further disturbance takes place. I have seen, in several cases, scars on the posterior portion of the hymen which were clearly the result of rupture. A Eurasian girl of about ten years, was brought to me by her mother who had caught her in the position of copulation with a boy of about fourteen. There were no signs of recent intercourse, but at the posterior part the hymen, which was crescentic, there were two pale linear scars, extending from the orifice to the base. After some questioning, the girl acknowledged that intercourse had taken place with the boy, during the previous vacation, about six months before.

If the examination is made soon after intercourse, there may be a little blood about the parts, the edges of the lacerations are raw, the flaps of hymen will be congested, swollen, and tender. Bleeding is usually slight, unless the hymen is thick and fleshy when it may be considerable ; profuse bleeding, which sometimes follows the first coitus, but especially in rape on children, is generally due to laceration of the perineum or vagina.

After a few days the inflammatory hyperæmia and swelling subside, union has taken place, or if prevented by repeated stretching of the parts, the edges of the laceration will have healed. The flaps gradually contract, forming small nodules, the carunculæ myrtiformes.

Coitus is not the only way in which rupture of the hymen may be caused. It may be torn by the introduction of the finger, or any firm body. It might be ruptured by a fall on a pointed object, but in such case, it is very improbable that the injury would be confined to the hymen. Forcible separation of the thighs is said to have ruptured the hymen, this is not possible, unless the perineum was also torn, which would only occur if the limbs were actually dislocated ; and in children, not even then, as the hymen is deeply placed. Casper mentions a case in which the hymen was lacerated by the child's mother, first by the fingers, then by a long stone introduced into the vagina. Chevers states that, in India, parents sometimes use mechanical means to dilate the vagina ; pieces of sola pith are inserted, the girl being made to sit in water which causes the pith to swell. It is said that masturbation may rupture the hymen. This is very improbable, especially in young children, as the sensitive parts, the clitoris and inner surface of the labia, lie in front. In young women, the entrance of the vagina may be erogenous, but generally not until after intercourse.

Riding, dancing, leaping, the passage of the blood clots in menstruation, and discharges from the vagina are said to have ruptured the hymen ; this is very improbable.

The conclusion, which Casper comes to regarding the signs of virginity, is accepted by medical jurists. He says " that when a forensic physician finds a hymen still preserved, even its edges not being torn, and along with it (in young persons) a virgin condition of the breasts and external genitals, he is then justified in giving a positive opinion as to the existence of virginity, and *vice versa*." In a young adult virgin, the breasts are firm, elastic, and hemispherical, the nipples are round, the areola is dark in dark persons, rose coloured in fair ; there may be a little milky secretion in the breasts. Coitus does not alter the breasts unless pregnancy results.

SEXUAL CRIMES.

Rape.

According to the Indian Penal Code, Section 375 : "A man is said to commit 'rape' who, except in the case hereinafter excepted, has sexual intercourse with a woman under circumstances falling under any of the five following descriptions :—

First.—Against her will.

Secondly.—Without her consent.

Thirdly.—With her consent, when her consent has been obtained by putting her in fear of death, or of hurt.

Fourthly.—With her consent, when the man knows that he is not her husband, and that her consent is given because she believes that he is another man to whom she is or believes herself to be lawfully married.

Fifthly.—With or without her consent, when she is under twelve years of age.

EXPLANATION.—Penetration is sufficient to constitute the sexual intercourse necessary to the offence of rape.

EXCEPTION.—Sexual intercourse by a man with his own wife, the wife not being under twelve years of age, is not rape."

Section 90 lays down :—" A consent is not such a consent as is intended by any section of this Code, if the consent is given by a person under fear of injury, or under a misconception of fact, and if the person doing the act knows, or has reason to believe, that the consent was given in consequence of such fear or misconception ; or

if the consent is given by a person who, from unsoundness of mind, or intoxication, is unable to understand the nature and consequence of that to which he gives his consent ; or

unless the contrary appear from the context, if the consent is given by a person who is under twelve years of age."

The Courts have held that the slightest penetration of the male organ within the vulva is sufficient to constitute rape. It is evident that the signs of virginity may be present in a woman on whom rape has been committed. In this country, owing to the custom of early marriage and cohabitation on the first appearance of the menses, signs of recent defloration are seldom found in Hindu and Mahomedan women above the age of puberty, and evidence of rape must be looked for in the signs of a struggle, marks of injury on the thighs, external genitals, and other parts of the body, and in the presence of semen in the vagina, about the vulva, and on the clothes.

Rape is much more often perpetrated on children than on adult women. In many of the cases of alleged rape on children sent for examination, no injury was found on the vulva, apparently no attempt had been made to penetrate; in some of the cases seminal stains were present on the child's cloth. In one case of a Eurasian child, aged about three years, the front of the drawers was stained with semen. Apparently in this and in other cases, sexual gratification was obtained by pressing the body of the penis against the vulva. But penetration may be attempted, even in very young children, and severe, sometimes fatal injuries have been caused to women as well as to children. The following cases illustrate the injuries generally produced in children by penetration:—A girl, aged six years, was brought for examination by her father, about forty-five hours after the occurrence. Her cloth was very dirty, and showed stains which the Chemical Examiner found to be of blood. There was a rupture of the perineum in the middle line, almost to the rectum; it extended through the hymen into the wall of the vagina, the edges were raw, inflamed, and tender. There were dried blood stains about the parts and on the thighs. The father stated there had been much bleeding which was stopped by the application of water. The child walked freely and showed no sign of being in pain. Her account was that the man (she did not know his name) took her to the bamboo grove, put her on her back and promised to give her some pice. Her statement stopped at this point, nor could she be persuaded to tell what further occurred; she was a particularly restless child, her demeanour suggested imbecility.

A similar injury was present in a Eurasian girl of ten years of age, produced by voluntary intercourse with a youth, aged seventeen. I examined the girl and the accused within an hour of the occurrence; the girl was bleeding freely and the vagina was filled with clots. There was a rupture, about half an inch deep, passing through the hymen into the vaginal wall and perineum. The girl admitted she consented on the promise of some pice. The act caused great pain and bleeding which she tried to stop by applying water; she also stated that she washed her garment. Being frightened by the bleeding she told her grandmother. The youth's account was substantially the same, he assisted in trying to stop the bleeding, and helped to wash the garment. He stated that penetration was partial, which seemed probable, having regard to the size of his penis. At the sessions, the youth was acquitted, the girl not being under ten and having consented; the case occurred before the age of consent was raised to twelve years.

Fatal injuries have been caused by the male organ in cases of rape and also in intercourse with a child wife. The perineum has been completely torn, the vagina extensively lacerated into the bladder and rectum, the peritoneal cavity has been opened. I saw recently a child wife, in a pulseless condition from hæmorrhage from within the vagina, due to injury caused by her husband, a youth under twenty, during copulation. From the appearance of the orifice of the vagina, it was evident that connection had taken place for some months. The exact injury was not made out, as it was deemed inadvisable to make an examination. The girl recovered, though several days after the first bleeding, there was a severe recurrence, which brought her again to the point of death.

In some cases, it is probable that the injuries are caused by the introduction of the fingers with the object of dilating the parts, but the force of the penis is sufficient to cause them, especially in children.

Rape may cause death by shock due to fright and mental emotion. Women have been killed by the means used to overcome their resistance and to prevent them calling for help. Death has resulted from suffocation produced by the hand or a cloth pressed over the mouth and nostrils, also from throttling, and from pressure on the chest.

Grave constitutional disturbance has been caused by rape, convulsions and epileptic seizures in children, mental derangement in older females.

The question—can a man unaided have complete intercourse with an adult woman of ordinary strength and in complete possession of her senses, requires careful consideration. If there is great disproportion between the strength of the man and of the woman, her resistance would be overcome; and even when more equally matched as regards strength, if the woman was surprised by a sudden attack, she might be thrown down and placed in a position in which she could not use her strength. Moreover, the fright caused by the attack might paralyse her resistance. A woman accustomed to manual labour would be better able to resist than a woman who had never had occasion to use her strength, and she would be less quickly exhausted. Rape, as defined by law, would be more easily accomplished than complete intercourse.

False charges of rape are often made ; it is necessary to be particularly careful in examining all signs of an alleged struggle. Women have inflicted injuries on themselves, generally about the external genitals, with the object of strengthening a false accusation. The injuries received in a struggle, are usually scratches and bruises about the thighs, external genitals, and other parts of the body ; the lips may be bruised, the inner surface cut by the teeth from pressure of the hand to prevent calling for help.

In young children, marks of resistance are seldom found ; their absence in an adult does not imply that she consented, a weak woman is at once overpowered by a strong man, and unless he uses unnecessary violence, no sign of injury may be present.

Women have been induced to consent by threats directed against themselves or others. Maschka records an instance of a woman consenting, in order to save her infant, which a man had seized and threatened to kill unless she submitted.

The question, whether rape can be committed on a woman during natural sleep, without her knowledge and consent, has been considerably discussed. It is probable that complete intercourse might take place with a woman habituated to coitus without disturbing her, but not with a virgin, the pain caused by the first intercourse would awaken her from natural sleep. It is possible that vulvar penetration which is sufficient to constitute rape might, under special circumstances, take place without disturbing a virgin, though it is not probable.

In abnormal sleep and in conditions of trance a virgin could be ravished without her knowledge, and it is possible that on awakening she might not realize that she had been outraged. Ogston quotes a case :—A servant woman proved pregnant and solemnly declared that she was not conscious of having had intercourse with any man. Subsequently a man acknowledged that he believed he was the father of the child ; that, having found the woman in a deep sleep from fatigue caused by long continued exertion and being kept out of bed two or three nights in succession, he had connection with her, and, as he believed, totally without her knowledge, as she did not evince the slightest consciousness of the act at the time, or recollection of its occurrence afterwards.

The case illustrates the fact that pregnancy may follow rape ; at one time, there was a belief that pregnancy only occurred when intercourse was voluntary. There was also a belief equally erroneous, that pregnancy never followed the first act of intercourse.

A woman may be drugged with opium or other narcotic and raped without her knowledge. In cases of alleged rape, women have accounted for the absence of signs of resistance by stating they were drugged or chloroformed. Such statements require close examination, the woman should be questioned minutely regarding the circumstances. Some of the cases are true, others false, made up, when discovery has taken place or when pregnancy has occurred. Among the public of all classes, there exists a very exaggerated and erroneous view of the potency of chloroform ; many people believe that a handkerchief on which a few drops of chloroform have been sprinkled, if waved in front of the face, will produce immediate unconsciousness. A tale of this kind is sufficient to disprove the woman's statement. In cases where drugging is alleged, the woman, not infrequently, gives a very circumstantial account of the occurrence, which is not compatible with a state of unconsciousness. The question whether a person in normal sleep can be brought under the influence of chloroform without awakening, may be brought forward. Experiments have shown that a skilled chloroformist has occasionally succeeded in chloroforming a sleeping person without awakening him, but in most cases, he has failed ; it is consequently in the highest degree improbable that an unskilled person would be successful.

Not infrequently medical men and dentists have been accused of rape by females who had been put under an anæsthetic for the purpose of undergoing an operation. In some cases, the charge has been brought honestly, the woman being convinced that she was outraged while unconscious. It appears that chloroform and other anæsthetics may give rise to erotic hallucinations, which may be extremely vivid and persist after consciousness has returned. The woman usually states that she was not completely unconscious, that she was aware of all that occurred though unable to offer the slightest resistance. Accusations of this description have been made in cases where the anæsthetic was given in the presence of several persons, including the woman's parents.

It is evident that a medical man should never put a female under an anæsthetic, except in the presence of other persons, one of whom, a woman.

Examination of the Female.—Before a woman is examined her consent must be obtained. It is advisable to put the question to her in the presence of witnesses and to write her answer on the form in which the result of the examination is recorded. In the case of a child, the consent of the parent or guardian must be given. It often happens that a woman who has laid a charge of rape and in reply to the question of the Magistrate declares her willingness to submit to examination, changes her mind and refuses her consent when she is brought to the medical officer. It may be pointed out that no order from a Magistrate, Judge or other authority, gives the right to examine a woman against her consent, whether she stands in the position of an accuser, or of an accused. Her consent must be given freely, not under compulsion, nor from a belief that she must consent.

Having obtained her consent, the woman may be asked to describe the occurrence. The date and hour of the examination should be recorded, and the time of the alleged assault. The woman's account should be recorded in her own words, she should be encouraged to speak freely ; questions may be put to clear up doubtful points in her statement and to obtain all particulars. It may be pointed out that in genuine cases of rape, the woman often gives an exaggerated description of the struggle and of the injuries sustained, which the examination of her person does not corroborate.

A woman who has been outraged, cannot be expected to give a very accurate description of the occurrence, her narrative is likely to be confused and to exhibit palpable exaggerations and errors. On the other hand, a designing female, who determines to lay a charge of rape against a man, will probably tell a very circumstantial and plausible story. Children, in true and in false cases, are often tutored by parents regarding the statement they are to make to the medical examiner. I have heard little girls, seven or eight years old, give without hesitation or stopping, a very detailed account of what the man did and what they did. It is as well to make the parent, or guardian stand behind the child while she is describing the occurrence and having written down her account to defer questions until after the examination of her person.

The examination must be thorough; it is convenient to get the woman to point out on her clothes and on her person all marks of a struggle. It is as well to ask whether the clothes she is wearing are those worn at the time of the occurrence. All scratches and bruises on her face, wrists, limbs, and body generally, should be noted, their extent, position, appearance, and probable duration described; the question whether they corroborate the woman's statement requires careful consideration.

For the examination of the genitals, the woman should be placed in the lithotomy position, the thighs well separated. Bruises, and scratches on the thighs, and vulva should be looked for, also stains of blood and semen on those parts, and on the clothes. If the examination is held within a day or two of the occurrence, the parts are likely to be tender and inflamed, a solution of cocaine may be applied, it will lessen the pain and facilitate the examination. Laceration of the hymen is the most reliable evidence of the loss of virginity. The ruptures should be carefully examined to determine whether their appearance is consistent with the woman's statement as to the time of the occurrence. It has been previously pointed out that in Hindu and Mahomedan women signs of recent defloration are seldom found, owing to the custom of early marriage, and marital intercourse on the first appearance of the menses. The signs of defloration in women and children have been described in a previous page.

The presence of semen in or about the genitals of the female, or on her clothing, is strong evidence of intercourse and, if the question of consent can be decided, of rape. A small quantity of the fluid found in the vagina should be removed with a glass rod and submitted to microscopical examination ; the presence of spermatozoa is positive proof of the nature of the secretion. Dried secretion on the external genitals and thighs should be removed and examined, semen may be found among the hairs, even after washing. Stains on the clothing should be submitted to the Chemical Examiner, to whom fluid from the vagina placed between clean glass slips and dried should also be sent. Semen can only be distinguished with certainty by the presence of intact spermatozoa. The examination is simple, a drop of the fluid is placed on a glass slip, covered with a cover-glass, and examined under the microscope, a lens of fairly high power is required, one-sixth or one-seventh, with an eye piece giving a magnifying power of three to four hundred diameters. Spermatozoa are minute thread-like bodies, consisting of an oval, flattened head and a long filamentous tail, the entire length varies from $\frac{1}{1000}$th to $\frac{1}{600}$th of an inch. In fresh semen, they exhibit very lively movements which cease rapidly on the addition of water ; when dried they are extremely resistant, and have been demonstrated in stains on cloth after months and even years.

There exists in India, as well as in Europe, a belief that connection with a virgin is a sure cure for gonorrhœa and other venereal diseases. This belief accounts for some of the cases of rape on children. The presence of a discharge from the genitals should always be noted in cases of alleged rape, and endeavour made to determine its character. Women and children not infrequently suffer from mucopurulent discharges of non-venereal origin. Among the children of the lower classes in this country, vaginal discharges are extremely common, their causation is in most cases evidently due to dirt, or irritation of thread worms, but in some instance, they appear to be venereal, which is not surprising, having regard to the neglect of all precautions against spreading the infection by the lower classes, among whom gonorrhœa is very prevalent. In the acute stage of gonorrhœa, the presence of the gonococcus can generally be demonstrated ; in the later stages, it is usually absent. Except by the presence of the gonococcus, it is not possible to distinguish a gonorrhœal from a non-venereal discharge. The investigation of a discharge for the presence of the gonococcus should be undertaken by an expert bacteriologist, who alone is competent to give an opinion with the certainty necessary in a medico-legal investigation.

If the examination of the female, in a case of alleged rape, is made soon after the occurrence, the presence of a purulent discharge is probably not connected with the act. If the accused is suffering from any form of venereal affection, it is advisable to examine the female a second time some days after the occurrence that time may be allowed for the development of the disease. The incubation of gonorrhœa extends from a few hours to a few days, usually from one to two days, chancres may appear in about the same period but the initial sore of syphilis has an incubation which may extend to three or four weeks.

The first coitus may cause a muco-purulent catarrh, especially in females suffering from leucorrhœa ; in cases of rape, if much force was used, the discharge may be profuse and purulent, and if the accused is found free from any sign of gonorrhœa or other discharge, the erroneous conclusion may be come to that he could not have been the ravisher. Irritation by the finger or any solid substance may set up a muco-purulent catarrh, similar to that resulting from coitus.

The Examination of the Accused.

His consent is necessary, just as it is in the case of a female. As a rule, the examination does not afford much information. If the accused was caught in the act or before he had opportunity of washing, marks of blood and semen may be found on his genitals and clothes. Hairs differing from those of his pubes may be adhering to his penis or scrotum or on his clothes. Careful examination should be made for signs of venereal disease. He may present marks of a struggle, scratches and bruises about his face and other parts of the body. The general appearance of the man should be noted with the object of comparing his strength with that of the female. The development of his genitals should also be noted as, not infrequently, impotence is put forward in defence of a charge of rape. If the accused makes a statement, it should be carefully recorded. Rape and indecent assaults on children are not infrequently committed by elderly men. The child may exhibit signs of injury to the genitals, caused by the penis or by the fingers, in most cases it is not possible to determine from the nature of the injuries how they were caused, but sometimes marks of finger nails may be found. In some of these cases, the fingers are used first to dilate the parts for the insertion of the penis. The mental condition of elderly men charged with rape or indecent assault should be inquired into ; in many cases, one of the earliest symptoms of mental degeneration has been sexual depravity.

If the accused is a boy, his age may have to be determined. According to the Indian Penal Code, Section 82 : "Nothing is an offence which is done by a child under seven years of age." Section 83 : "Nothing is an offence which is done by a child above seven years of age and under twelve, who has not attained sufficient maturity of understanding to judge of the nature and consequences of his conduct on that occasion."

It appears, however, that offences against certain sections of the Railway Act committed by children do not come under the general exceptions mentioned in Sections 82 and 83 of the Penal Code.

On several occasions I have examined little boys charged with rape and have found no sign of the alleged offence.

The duty of a medical jurist in cases of alleged rape is most responsible. From the circumstances under which the crime is usually committed, his testimony is often the only independent evidence available, and great reliance is placed on it.

In rape on a woman accustomed to sexual intercourse, especially on one who has borne children, the local signs are generally negative, and if the woman is of feeble strength compared to the man, or of a timid disposition, marks of resistance may be very slight or altogether absent. The investigation of fluid from the vagina and of stains on the vulva or clothes may show the presence of semen which would prove sexual contact, and so far corroborate the woman's statement. The presence of semen can only be proved by finding spermatozoa ; but they may be absent, temporarily or permanently, in the semen of even a robust man, or they may be few in number and hence not found. In examining fluid or stains suspected to be seminal, several specimens should be searched before concluding that spermatozoa are absent.

A woman was brought for examination ; she was about fifteen years of age, strong, muscular, a native of Simla. She consented to the examination and gave a detailed account of the occurrence which had taken place the day before. There were no signs of a struggle, which she accounted for by the suddenness of the attack and her fright. Her cloth was stained with blood and the part over the vulva was wet with fresh blood. Bleeding was going on from inside the vulva. On attempting to separate the labia she cried out and refused to allow me to proceed. It is probable that the bleeding was due to menstruation, the woman, no doubt, expected that the presence of blood would be held sufficient proof of the truth of her statement. Menstrual blood cannot be distinguished from blood derived from a wound. If the flow is scanty, it becomes acid by admixture with the vaginal secretion, but, if copious, the blood is normal in appearance and reaction. The presence of much mucus and vaginal epithelium would point to a menstrual origin, but not with sufficient certainty for a medico-legal opinion. In the case mentioned, it was subsequently ascertained that the woman was in the keeping of man who annoyed her by refusing a request, and in revenge she made a false charge of rape against him.

Unnatural Offences.

Indian Penal Code, Section 377 : " Whoever voluntarily has carnal intercourse against the order of nature with any man, woman, or animal, shall be punished with transportation for life, or with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine.

Explanation.—Penetration is sufficient to constitute the carnal intercourse necessary to the offence described in this section."

The various forms of unnatural intercourse are comprised under the terms, Sodomy, Tribadism, and Bestiality.

Sodomy means anal intercourse between two men or between a man and a woman ; pederasty is the same, the passive agent being a boy.

Tribadism is a form of sexual gratification practised between two women, the clitoris of one being inserted in the vagina of the other. It does not appear to have come before the courts in India, it has therefore little medico-legal importance.

Bestiality means intercourse between a man or a woman and an animal.

Unnatural sexual intercourse has been practiced in all ages and in all countries ; throughout the East it is very prevalent in the present time, in China it appears to be looked on as a legitimate and proper pleasure. In India, sodomy is very common, especially in some parts of the country ; in Calcutta, prostitutes are frequently used in an unnatural manner, many of the women who take admission to the Voluntary Venereal Hospitals show signs of anal coitus. Among boys it is also of very frequent occurrence.

Krafft-Ebing and other authors, who have studied the subject of sexual perversion, divide the cases into two classes—congenital and acquired. The first includes those individuals who from the earliest period of sexual development, manifest desires of an abnormal character. Individuals of this class are often neurotic, and generally belong to families in which there is a history of mental disorder. The acquired form may be due to unrestrained indulgence in sexual connection, which produces a condition of satiety and impotence for normal coitus, the individual then seeks to obtain gratification in unnatural acts. Masturbation, especially when excessive and begun at an early age, may render the individual impotent for normal intercourse. In countries where unnatural vice has prevailed from the earliest times to the present day, it is probable that the practice is largely the result of custom and example. It appears to be not uncommon for men to take sometimes the part of the active agent, sometimes that of the passive. There are also individuals who habitually, as a trade, take the part of passive agents ; many of them are eunuchs and profess to live by dancing and singing, some have been castrated in early childhood in order to be brought up to the trade, others voluntarily undergo the operation in adult life ; some retain their genitals.

THE SIGNS OF SODOMY.

The consent of the accused must be given before the examination is undertaken. It is advisable to examine the anus and the penis of both the parties, as it is not always clearly known which rôle they took in the act.

The active agent shows no signs of the act; Tardieu has described certain changes in the penis of individuals who have practised sodomy for a long time, but most authors hold there is no sign by which active sodomy can be recognised.

In the passive agent, long continued use may cause alterations in the appearance of the anus, a relaxed state of the sphincter, and a patulous condition of the opening, protrusion of the mucous membrane, fissures, and purulent discharges from the anus. The normal folds in the skin about the anus may be obliterated and a funnel or trumpet shaped depression may be present. Among the prostitutes in the Voluntary Venereal Hospitals, ulceration and syphilis of the rectum are very common; in some of the older women who have been practising for many years, the sphincter seems to have completely lost its power, the anus in gaping, fissured, and purulent discharges exude from it. Stricture of the rectum is common among the women.

In individuals who occasionally take the part of the passive agent, no change in the appearance of the anus occurs. Laceration of the mucous membrane of the rectum could only happen when much violence was used and the penis is unusually large and rigid. I have, on several occasions, examined youths on whom sodomy had recently been committed with their consent, and in not one was there any sign of injury. When the sphincter is voluntarily relaxed, as it was in these cases, the penis does not, as a rule, cause any injury. Sodomy is often attempted on children; in one case of a boy of seven, outraged by a servant, there was profuse bleeding which appeared to come from a tear in the skin at the verge of the anus, no other injury was detected. It is probable that the sphincter was not penetrated. In most of these cases no injury was found and having regard to the strength of the sphincter, it seems that gratification is generally obtained between the nates without penetration.

Semen should be looked for about the anus and on the clothes. In children and women, it would be evidence of great value; spermatozoa found within the rectum would be positive proof.

False charges of sodomy are not uncommon. I have examined a strong coolie who alleged that sodomy had been committed on him while he was asleep in the lock-up of a police station, by a man of about the same strength. There was not the slightest sign of the occurrence and no marks of a struggle. More often the allegation is that the accused outraged a child ; in some cases, the charge is brought honestly, but frequently, it is instigated for revenge or for the purpose of blackmail. In one instance, an old man brought his grandson and stated that a fellow resident in the alms-house had committed sodomy on the boy. The grandfather did not allege that he had seen the occurrence, but he noticed that after the boy had been in a room with the accused, he walked as if in pain and was constantly putting his hand on the anus. On examination, I found scratches about the anus and a ring of excoriation, and also thread-worms in large numbers. It came out afterwards that the grand-father and the accused had had a quarrel, after which the charge was made.

BESTIALITY.

Evidence of this offence is seldom found ; in the passive agent spermatozoa may be detected in the vagina and also sign of injury. In one case, a man was caught in the act with a calf, his cloth was covered with blood, his penis was also blood stained. The calf bled profusely from tears within the vagina. The accused confessed his crime before the Magistrate.

CHAPTER XXI.

PREGNANCY.

Under various circumstances a medical jurist may be required to examine a woman with the object of determining whether she is pregnant. During the early stages of pregnancy, the diagnosis cannot be made with the certainty necessary in medico-legal cases ; it is not until the later months that signs are found, on which a positive opinion can be given. But in the later months and even up to the commencement of delivery, the diagnosis may remain doubtful, owing to the failure of the examiner to discover those signs, which are of absolute value ; there are instances on record, of skilled gynæcologists having failed to recognise the existence of pregnancy even in the advanced stage, and the abdomen has been opened with the object of removing a tumour which was found to be a pregnant uterus.

The signs of pregnancy may be divided into those caused by the changes in the maternal organization, and those produced by the growth of the ovum. The former are only of corroborative value, the second include signs which justify a positive opinion. The first division includes suppression of the menses, morning sickness, changes in the breasts ; these signs may be absent, and they may be caused by conditions other than pregnancy. The changes in the breasts may be noticeable by the second month, the nipples become more prominent, the areolæ enlarged and darker, the glands enlarged.

Changes in the Uterus.

During the first three months of pregnancy the body of the uterus grows more in breadth and depth than in length, it becomes globular and retains this shape up to the sixth month, after which it gradually lengthens to a pear shape. At about the second month, the cervix becomes softened, due to serous infiltration ; the softening extends into the uterus and becomes more marked. The mucous membrane of the vagina and vulva has a cyanosed appearance, its colour changes from the light pink of the unimpregnated state to pale violet. This change is noticeable in the second month. The size of the uterus increases gradually and its position alters. At the third month, it may be felt, if the abdominal wall is thin, behind the symphysis pubis. In the fourth month, the fundus has risen out of the pelvis; by the fifth month, it is midway between the symphysis and the navel; by the seventh month, it is above the navel; during the ninth month, it reaches its highest point, nearly at the epigastrium. For a week or two before delivery, the fundus becomes lower, the fœtus sinks deeper into the pelvis.

During the fourth month, the uterus comes in contact with the abdominal wall and the mother first feels the movements of the fœtus and experiences what is called "quickening." The period at which quickening is noticed varies, and it may not be felt at all. It generally occurs about the middle of the fourth month. It a subjective sign and therefore of little medico-legal value. The medical jurist may, by auscultation, detect fœtal movements before they are recognised by the mother, and before the fœtal heart sounds are audible. In the later stages of pregnancy, the movements may be easily detected by palpation and may be visible.

The presence of the fœtus within the uterus may also be detected by ballottement, which is obtained by placing the woman in the dorsal position, or standing up, the index or two fingers of one hand are introduced into the vagina, while the fundus is pressed with the other hand. The finger in the vagina resting in front of the cervix is pushed smartly upwards. The push causes the fœtus to recede, and after a moment, it falls back against the finger.

Ballottement is available between the fourth and the seventh month.

Throughout pregnancy gentle painless contractions of the uterus take place at short intervals, they are a valuable aid in diagnosis, but they are not always detected even in the later stages of pregnancy.

Fœtal heart sounds can generally be detected during the fifth month; if the examiner can satisfy himself of their presence, he is in a position to give a positive opinion of the existence of pregnancy. Failure to discover these sounds does not negative pregnancy, nor imply that the fœtus is dead. The sounds resemble the ticking of a watch heard through a pillow.

By careful palpation of the abdomen, in most cases, it is possible to detect the movements of the child and the different parts of its body. But excess of liquor amnii, or very fat abdominal walls may prevent these signs being discovered.

A medical jurist is justified in giving a positive opinion regarding the existence of pregnancy if he hears the fœtal heart sounds, or detects the movements and the presence of a child's body, but failure to discover these signs does not prove the non-existence of pregnancy. It is evident that before the fifth month no positive opinion is possible, as before that period the fœtal heart sounds cannot be distinguished with certainty.

In the dead, the existence of pregnancy is proved by the presence of the embryo within the sac of the ovum, and in the later stages, of the fœtus and placenta.

There are certain abnormal products of conception which may be found in place of the embryo. In some cases, the chorionic villi undergo cystic degeneration, become enlarged and form minute vesicles, like small grapes, the embryo dies and, as a rule, no trace of it can be found. The disease usually begins within the first two months of pregnancy. The development of the cysts takes place rapidly, and the uterus is larger than at the corresponding period of normal gestation. The disease is known as vesicular or hydatidiform mole.

Occasionally hæmorrhage takes place into the sac of the ovum, the embryo is destroyed, and a firm fleshy mass is produced called a carneous or sanguineous mole.

Moles prove that conception has occurred. As a rule, the sanguineous mole is expelled within a few weeks of its formation or earlier. The vesicular mole may remain longer, but it is seldom retained after the fifth month.

SIGNS OF DELIVERY.

In connection with infanticide, feigned delivery, libel cases, and concealed birth, it may be necessary to determine whether a woman has been recently delivered. The examination can only be made with her consent.

A woman who has been delivered at full time, generally presents for one or two days, longer if she is delicate, or if the labour was protracted or difficult, an appearance of langour and exhaustion. The abdomen may be slightly full, but lax and the skin wrinkled. The pregnancy scars or lineæ albicantes are seen on the skin of the abdomen ; these so-called scars are due to the stretching of the cutis and separation of the bundles of connective tissue. They also occur from dropsy, ovarian tumours, obesity, or other cause of distention of the abdominal walls ; they are seen on the thighs of people who have been fat. The breasts are full and on pressure colostrum or milk exudes. For two or three weeks after delivery there is a discharge from the uterus and vagina, called the lochia. During the first three or four days, the lochia consists of blood ; for the next three or four days, it is serous, composed of serous exudation, shreds of decidua, granular and fatty debris ; later, it acquires a greenish colour. It has a peculiar disagreeable, rancid odour. The discharge ceases gradually and loses its lochial character, persisting for some time as a pale mucous discharge.

The fundus uteri can be felt above the pubes for the first ten days ; rhythmic contractions continue to take place in the uterus for some days. The vagina and labia bear marks of distention and injury ; the vagina gapes, lacerations are generally found, especially at the border of the perineum, the posterior commissure is destroyed. The cervix uteri is soft and patulous, its edges bruised and lacerated.

These signs are well marked for the first few days ; by the end of a week they have diminished greatly, by the end of a fortnight the diagnosis of recent delivery is generally impossible.

In "The Indian Medical Gazette" for May 1894, Dr. Kedar Nath Das reported an instance of extraordinary exertion by a woman immediately after delivery. "The woman, æt. 40, 1. para. a maidservant in a Bengali household, was delivered, unassisted, in an erect posture, of a mature child in the privy of her employer's house, at 11 A.M. on the 6th February 1893. She was doing her ordinary duties up to the time of going to the privy ; she lost much blood. The placenta came away in about an hour. She wrapped the child in rags and placed it on a shelf in the privy (according to her statement the child died from its head being knocked against the cement floor). After leaving the privy, she went about as usual, at 2 P. M. she walked to the Howrah station, about 2 miles, she started by the 10 P. M. train, made a journey of 97 miles sitting upright on a bench. After leaving the train, she walked 26 miles in three days, subsisting on *muri* or fried rice. On the 10th, she was captured by the police and brought back to Calcutta. She was admitted to the Eden Hospital on the morning of the 12th and examined by Dr. Das. He found her rather weak, all the organs healthy, the signs of recent delivery were present. The woman was charged with infanticide and concealment of birth and was convicted on the latter charge."

The case illustrates the extraordinary exertion and endurance a woman is capable of immediately after confinement when actuated by a strong motive.

In the dead body of a woman recently delivered at term, the signs previously described are present ; the uterus is a flattened, flabby bag, 9 to 12 inches in length, and about 30 ounces in weight ; the cervix is gaping wide, the walls are soft and flabby. The cavity usually contains clots of blood, its surface has a ragged appearance, due to pieces of partly detached decidua and mucous membrane. The site of the placenta is indicated by the smooth appearance of the surface, darker colour, and the large venous sinuses, plugged with thrombi.

The uterine vessels in the broad ligaments are large, the veins tortuous.

The size and weight of the uterus diminish rapidly after delivery, especially during the first week.

Table showing the size and weight of the uterus at different periods after delivery.

Period.	Weight in ounces.	Size in inches.
Immediately after delivery	30	8 to 12
Two or three days ...	20 to 24	7 to 8
Seven days	16	5 to 6
Fourteen days ...	12	4
Two months ...	1 to 1¼	3

Involution is complete in about two months, the uterus remains permanently larger and its shape also differs from the nulliparous condition.

The nulliparous uterus differs from the uterus of a woman who has borne children to full term. The length measured externally from the highest point of the fundus to the external os is about 2½ inches. A slight constriction is apparent externally, dividing the length into two almost equal parts, the upper slightly longer portion, includes the body and fundus, the lower portion comprises the cervix. The top of the fundus is flat, rising hardly at all above the level of the Fallopian tubes. The external os is either round or transverse, smooth and devoid of scars. If a longitudinal section is made, from side to side, dividing the organ in two, anterior and posterior, halves, the cavity of the body is seen to be rather shorter than the cavity of the cervix, somewhat triangular in shape, the walls convex inwards, and the space small. The cavity of the cervix is fusiform, and marked, anteriorly and posteriorly, by a longitudinal ridge from which secondary ridges branch obliquely upwards, producing the arbor vitæ.

The parous uterus compared with the nulliparous, is larger, and its walls thicker. The total length externally is about three inches, of which two inches go to the body and fundus, one inch to the cervix. On longitudinal section the cavity is larger, somewhat pear shaped, the walls are concave inwards. The top of the fundus externally is arched upwards above the level of the Fallopian tubes. The external os may be either round or transverse, its edges are irregular, it may admit the tip of the finger.

For some months after delivery, the sinuses of the placental site are visible. The walls of the uterine arteries, which undergo thickening during pregnancy, remain permanently thicker than those of the nulliparous uterus.

The changes in the shape and size of the uterus which are due to pregnancy, except those of the vessels in the placental site, might possibly be caused by an intra-uterine tumour, but its presence, or the remains of its pedicle will probably enable the diagnosis to be made.

In recent delivery there is generally present in one of the ovaries, a so-called true corpus luteum, which is usually about the size of a small bean, it may be larger; on section, it exhibits a cavity, containing fluid, or a blood clot, surrounded by convoluted yellow membrane. The corpus luteum is produced by changes in the Graafian follicle after rupture and discharge of its contents. Bleeding takes place into the cavity, the membrana granulosa proliferates and being confined, is thrown into folds. The corpus luteum of pregnancy increases in size for three or four months, it diminishes slowly, and at the time of delivery, it may still be half an inch in diameter. The yellow colour is due to changes in the cells of the membrana granulosa.

As a sign of recent delivery it has a corroborative value only ; I have many times found a corpus luteum exactly similar in size and appearance to that of pregnancy in non-pregnant women, and in women in whom the uterus presented a nulliparous form. The corpus luteum may be absent in a case of pregnancy.

Signs of Remote Delivery in the Living.

If a woman has given birth to several children at term, her breasts, especially if she has suckled the children, are pendulous, nipples long. The abdominal walls are less firm and elastic, and marked by silvery streaks or pregnancy scars, the vulva is patulous, the posterior commissure is destroyed, the hymen has completely disappeared or a few small carunculæ may persist.

The changes in the uterus have been described.

The signs are not of a kind to enable the diagnosis to be made with certainty in the living. A woman, who has had one child many years before the examination, especially if the birth was premature, a month or two before full term, will rarely present any signs of delivery.

ABORTION.

Sections 312 to 318 of the Indian Penal Code deal with the causing of miscarriage, injuries to unborn children, exposure of infants, and concealment of births.

Section 312 : "Whoever voluntarily causes a woman with child to miscarry, shall, if such miscarriage be not caused in good faith for the purpose of saving the life of the woman, be punished with imprisonment of either description for a term which may extend to three years, or with fine, or with both ; and, if the woman be quick with child, shall be punished with imprisonment of either description for a term which may extend to seven years, and shall also be liable to fine.

Explanation.—A woman who causes herself to miscarry is within the meaning of this section."

313. "Whoever commits the offence defined in the last preceding section without the consent of the woman, whether the woman is quick with child or not, shall be punished with transportation for life, or with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine."

314. "Whoever, with the intent to cause the miscarriage of a woman with child, does any act which causes the death of such woman, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine ;

and if the act is done without the consent of the woman, shall be punished either with transportation for life, or with the punishment abovementioned.

Explanation.—It is not essential to this offence that the offender should know that the act is likely to cause death."

315. "Whoever before the birth of any child does any act with the intention of thereby preventing that child from being born alive or causing it to die after its birth, and does by such act prevent that child from being born alive, or causes it to die after its birth, shall, if such act be not caused in good faith for the purpose of saving the life of the mother, be punished with imprisonment of either description for a term which may extend to ten years, or with fine, or with both."

316. "Whoever does any act under such circumstances, that if he thereby caused death he would be guilty of culpable homicide, and does by such act cause the death of a quick unborn child, shall be punished for a term which may extend to ten years, and shall also be liable to fine.

Illustration.—*A*, knowing that he is likely to cause the death of a pregnant woman, does an act which, if it caused the death of the woman, would amount to culpable homicide. The woman is injured but does not die; but the death of an unborn quick child with which she was pregnant is thereby caused. *A* is guilty of the offence defined in this section."

317 deals with the exposure and abandonment of a child under twelve years, by parent or person having care of it.

If the child dies the offender may be tried for murder or culpable homicide.

318 deals with concealment of birth by secret disposal of the dead body of a child.

Attempt to procure abortion can be dealt with under section 511, which refers to the punishment for attempting to commit offences punishable with transportation or imprisonment; or under section 328 causing hurt by means of poison, etc., with intent to commit an offence.

Medical men apply the term abortion or miscarriage to expulsion of the ovum before the time when the child becomes viable, and premature labour to expulsion after that date and before full term. In law, the term miscarriage is applied to expulsion at any period, short of full term.

The Indian Penal Code distinguishes between abortion in the early months of pregnancy and the miscarriage of a woman quick with child. The expression "quick with child" means that the development of the fœtus has reached that period when the woman feels the sensation of quickening, produced by the movements of the child. It is a subjective sensation felt by the mother usually about the middle of the fourth month, occasionally as early as twelfth week; women have gone to full term without feeling it and without being aware of their condition.

In cases of criminal abortion, the medical jurist may be asked whether the woman was quick with child. His reply will be based on the period of the pregnancy which can be determined by examining the fœtus. If the miscarriage occurred in the early months of gestation before quickening is possible, there will be no difficulty in giving a positive answer, but if it took place after the period when quickening is usually felt, great caution is necessary. The more advisable course is to describe the appearance of the fœtus, the stage of its development, and to state the usual period of pregnancy at which quickening occurs. The more advanced the period of the pregnancy the greater the probability that the woman experienced quickening, but the question does not admit of a positive answer.

The distinction, made in law, between causing the miscarriage of a woman with child and of a woman quick with child, should be done away with. It is based on an old and erroneous belief that quickening indicated the commencement of life in the child, whereas, life begins at the moment the ovum is fertilized by the spermatozoon. If it is necessary to separate the offence of causing miscarriage in the early and in the later period of pregnancy, the viability, or capability of the fœtus for a separate existence, would be a more logical distinction than one which depends on a sensation perceived by the mother.

Modes of Procuring Criminal Abortion.

It is necessary to bear in mind that abortion occurs frequently from non-criminal causes; it has been estimated that one pregnancy in five ends prematurely. Many abortions occur within the first few weeks unrecognised, or only suspected. A woman goes a few days, or a week or two, beyond the expected time of menstruation then a flow of blood takes place, rather more profuse than usual, and an ovum escapes unobserved.

The causes of a non-criminal abortion are divisible into conditions affecting the mother, and conditions primarily affecting the fœtus.

Maternal Conditions.—Acute diseases, fevers, zymotic diseases, chronic affections, Bright's disease, heart disease, anæmia, specific diseases, syphilis is one of the most common causes of repeated abortion, lead poisoning; causes acting through the nervous system. Abortion is often produced by sudden emotion, fright, grief ; some women are particularly susceptible to causes of this kind.

Local conditions, tumours, malposition of the uterus, inflammation and other local diseases.

Fœtal Causes.—If the fœtus dies, degenerative changes take place in the chorion or placenta, the ovum acts as a foreign body and expulsion occurs. The death of the fœtus may be due to malnutrition, syphilis or other diseases, or its vitality may be insufficient from the beginning for continued existence. Hæmorrhage into the placenta or membranes, separation or disease of the placenta, may cause the death of the fœtus. Separation may be caused by accidental falls or blows, or even by coughing, straining at stool, or vomiting.

Methods of Criminal Abortion are divisible into acts of general violence, mechanical means applied directly to the uterus or its contents, and the administration of drugs by the mouth.

General violence is sometimes resorted to by women to procure abortion, but as a rule without effect. Women have subjected themselves and have been subjected to extreme violence without aborting, jumping from a height, violent exertion, riding long distances, rolling downstairs, wearing a tight bandage round the abdomen, are some of the methods that have been used, often ineffectually. Women have sustained the most severe abdominal injuries without aborting.

Local mechanical means are more commonly employed. The introduction of an instrument of some kind into the uterus with the object of rupturing the fœtal membranes, or, in the early stage of pregnancy, to detach the ovum, is the most common method. The women who make the procuring of abortion a means of livelihood, become skilled, and, though most of them have had no medical training, manage to induce expulsion of the contents of the uterus without injuring the mother. The cases which come before the medical jurist are those in which the woman dies or her life is endangered. The usual cause of death is septic poisoning through a wound in the uterus. Having regard to the dirty habits of the class of women abortionists, it is surprising that more deaths do not occur. Of course there is no doubt many of the fatal cases are not brought to the notice of the Police.

Another method of abortion is by the introduction into the vagina of an irritating substance, which sets up inflammation and uterine action. Twigs of various irritant plants are used for this purpose, sometimes they are introduced into the uterus, but more often not beyond the os uteri. Twigs of Plumbago Rosea and Zeylandica, Lal Chitra and Chitra, are most commonly used, also, not infrequently, twigs of Oleander, and of Cerbera Thevetia. The juice of these plants and of others of similar irritating properties, Madar and various species of Euphorbia, are applied to the os uteri, or a rag wrapped round the end of a stick is soaked in the juice and introduced.

I have found a piece of lal chitra, also a rag soaked in the juice of some plant, within the vagina, in cases of abortion, fatal from septicæmia. Arsenic, white and yellow, red lead, bruised marking nut, have also been used to induce abortion. In fact almost every irritating substance known to the people has been used for the purpose.

The following fatal case of abortion appears from the history to have been caused by the woman on herself. Death was due to septicæmia ; the fœtus was not found.

A report was made to the police that a woman was very ill, and a few minutes later that she was dead. From inquiry, the Police learnt that the deceased was known to have been pregnant, and had changed her lodgings five days before her death. The day before she died, the landlady noticed that she appeared ill, and asked her what was the matter. The deceased replied she had fever ; in the evening, she was restless and in great pain, the symptoms increased rapidly and death occurred soon after the first report was sent to the police.

The post-mortem examination was held about 12 hours after death. The body was swollen from decomposition, the tissues were discoloured, the eyes jaundiced. There was a dirty cloth between the legs, and a discharge of offensive bloody fluid from the vulva. The orifice of the vulva was small and showed no sign of injury. The uterus measured 5½ inches, it contained very offensive blood clots, the mucous membrane was in a gangrenous condition. The os was patulous, the lips were softened and gangrenous. There was no sign of laceration, or puncture in the uterus or vagina.

The left ovary contained a corpus luteum about one inch in diameter.

The viscera were submitted to chemical analysis, a trace of morphine was detected.

It is probable from the appearance of the cervix and cavity of the uterus that abortion was caused by the application of some irritant, probably lal chitra. Before death, the woman said that she had caused abortion, she did not say when, nor what she had done with the fœtus.

In another fatal case of abortion, probably about the 8th month, the vagina was dilated ; the uterus, seven inches in length, was inflamed, and showed about the centre of the posterior wall a small laceration, in which a fragment of wood was sticking. Death was due to septic peritonitis. The uterus may be perforated in the attempt to rupture the fœtal membranes, women have forced an iron wire or similar instrument through the vagina and uterus, twigs and pieces of stick introduced into the uterus may be driven through the walls by uterine action.

Administration of Drugs.

The number of drugs used to procure abortion is very great, every purgative almost has been employed for the purpose. There are a large number of substances reputed to have the power of exciting uterine action ; most of them have no specific ecbolic effect, and when abortion follows their use, it is owing to the general gastro-intestinal irritation which they set up.

Ergot appears to possess direct ecbolic properties, though, as a rule, it is incapable of exciting action in the quiescent uterus. If uterine action is going on, the administration of ergot has the effect of rendering the contractions more powerful and frequent, large doses of ergot produce violent gastro-intestinal irritation and, at the same time, may set up uterine action. A strong healthy European woman, pregnant about two months, took teaspoonful doses of liquid extract of ergot, two or three times a day. After about a week, she was seized with severe abdominal pain, violent vomiting and retching, uterine action came on, and abortion took place after eight or ten hours. When the uterine pains began there was profuse hæmorrhage, which continued until the ovum was expelled. The woman was found in a state of profound collapse, pulseless, almost unconscious, an ovum of two months was extruding from the vagina. The bed was drenched with blood, and there were large masses of blood clot in various utensils. She complained of severe gastric pain, her tongue was red and irritable. By careful nursing, she gradually recovered.

Rue, savin, and pennyroyal are abortifacients of considerable repute among women in England. It is probable they have no ecbolic effect, and when abortion follows their use it is due to the general gastro-intestinal irritation which is set up.

In India, the number of substances used to produce abortion is very large—papaya seeds, carrot seeds, oleander, the juice of bamboo leaves, unripe pineapple; the juice of the various plants, used locally, may be given internally.

Strong purgatives may cause abortion, if used in large doses. Iron has been given for the same purpose. In fact almost every drug has been put to this use.

It appears that, except ergot, there is no drug which has a direct specific ecbolic action, and when abortion follows, it is due to to the general toxic action of the substance. During the last few years several cases of severe illness, and some deaths, of pregnant women, have been caused by diachylon plaster, taken to produce abortion. It seems to be an exceedingly dangerous substance and grave, even fatal symptoms have been caused without abortion occurring.

Quinine is said to produce abortion if given in large doses; this appears doubtful. It is true that abortion not infrequently occurs during the administration of quinine in cases of malarial fever, but it is more probable that the disease is the cause of the expulsion of the fœtus.

SIGNS OF ABORTION.

If abortion takes place in the first two months of gestation, no marks of sufficient distinctiveness to allow of a positive diagnosis are found. After the fourth month, signs of relaxation and stretching of the passages, enlargement of the uterus, relaxed state of the abdominal walls, signs of pregnancy in the breasts, are found. The nearer the pregnancy is to full term, the better marked the signs and the more closely they resemble those of delivery at term.

In the dead body, the vulva and orifice of the vagina having been examined, the uterus and vagina should be removed and subjected to careful scrutiny. The length and width of the uterus, thickness of its walls, state of the mucous membrane, character of the contents, condition of the os and cervix, should be noted. All injuries must be examined, position, direction, length, recorded ; all foreign substances found in the uterus and vagina should be retained for further examination, if necessary. The post-mortem examination must be complete ; the condition of every organ noted. It is advisable in all cases to have the viscera analysed. Abortion is not infrequently caused by the administration of drugs, combined with local violence.

If the fœtus is found, its age, viability, signs of live birth, cause of death, marks of violence, must be examined.

THE DEVELOPMENT OF THE FŒTUS.

At 1 month.—The ovum measures about $\frac{3}{4}$ inch, the surface is covered with chorion villi. The embryo is $\frac{1}{3}$rd inch long, curved, the caudal extremity slender and short, the cephalic end is thick, two dark spots indicate the eyes. The limb buds are visible ; the mouth is a cleft.

At 2 months.—The ovum is $1\frac{3}{4}$ inches in diameter. The chorion villi are enlarged at one spot. The embryo is $\frac{1}{2}$ inch in length ; the head is becoming distinct from the trunk ; the umbilical vesicle is very small, the vessels of the funis are still straight. The nasal and oral openings are distinct.

At 3 months.—The embryo is about 3 inches long, weighs about one ounce. The neck is distinct ; the chest can be distinguished from the abdomen. The fingers and toes are visible. The umbilical vesicle has disappeared within the abdomen. The funis is spiral, about $2\frac{1}{2}$ inches long.

At 4 months.—The embryo is $5\frac{1}{2}$ inches long. Weighs 3 ounces The skin is rosy and firm ; the sex distinguishable. The membrana pupillaris very evident. Funis 7 inches long.

At 5 months.—Fœtus is 6 inches in length, weighs 10 ounces. The nails are visible, also hair on the head, and lanugo on the forehead. The eyelids are closed. Funis 12 inches long. Bile stained fluid in the small intestine.

At 6 months.—Fœtus is 12 inches long, weighs 24 ounces. Vernix caseosa on the skin, which is red and wrinkled, lanugo on all parts of the body. Eyes closed, eyelashes and eyebrows are appearing. Funis, length 14 inches, is inserted a little above the pubes. Meconium in the large intestine.

At 7 months.—Fœtus is 14 inches long, weighs 2lbs. Eyes open, membrane pupillaris disappearing. Finger nails well formed, do not reach the finger tips. Lanugo has gone from the face. The testicles are in the vaginal process of peritoneum, at the internal ring. Funis length 17 inches.

At 8 months.—Fœtus 16 inches long, weighs 3 lbs. Skin is less red, less wrinkled ; there is a considerable quantity of subcutaneous fat. The nails have reached the finger tips. The umbilicus is below the centre of the body. At about 8½ months, the centre of ossification in the lower epiphysis of the femur appears.

At 9 months.—Fœtus is 18 inches long, weighs 6 to 7 lbs. The skin is firm and plump, vernix caseosa is present chiefly on the back and flexor aspect of the limbs. Lanugo on the shoulders. The umbilicus is above the centre of the body. The finger nails extend beyond the finger tips. The toe nails reach to the tips of the toes. There is meconium in the large intestine and rectum. The point of ossification in the upper epiphysis of the tibia is generally present at full term, but sometimes not until after birth.

The medical jurist has frequently in this country to examine a fœtus in a state of advanced putrefaction. He can determine whether full development had been reached by examining the lower epiphysis of the femur, the centre of ossification appears at about eight and a half month and at full term has a diameter of about one-fourth of an inch. The examination is made in the following manner :—The knee is bent and the joint laid open by a transverse incision, the femur is pushed through the opening, and with a sharp scalpel the epiphysis is sliced transversely. The slices should be thin. The centre of ossification is a more or less circular spot, having at full term, a diameter of a quarter of an inch. The earliest signs of the centre take the form of minute red lines which appear at eight and a half months.

The centres of ossification in the bones appear at different periods of fœtal life and afford assistance in determining the period of development. Ossification occurs in the clavicle before any other bone, the centre appears about the sixth week and extends rapidly, by the fourth month the body of the bone is ossified; centres appear on each side of the lower jaw about the seventh week. Ossification begins about the eighth week, in the bones of the head, spine, pelvis, and long bones of the arms and legs; and a week later in the metacarpal and metatarsal bones and in the phalanges.

In the sixth month, a centre appears in the manubrium of the sternum, and in the os calcis. In the seventh month, ossification commences in the astragulus. The cuboid bone generally begins to ossify at or a little before birth.

The dates of the appearance of the centres of ossification are those given in Quain's Anatomy; they differ somewhat from those of other authors.

At full term, the placenta is about seven inches in diameter and weighs one pound. The length of the umbilical cord is about twenty inches.

The question of the viability of a child may have to be determined under various circumstances.

Most authors hold that a child born at 180 days of gestation may live. A child may be born alive before this period, but it is not viable or capable of living. A fœtus of three or four months development may exhibit signs of life, movements of the limbs, etc., but it cannot continue to live, owing to the want of development of the respiratory muscles and respiratory centre. Most six months children die immediately, or within a few days of birth; occasionally one has been reared, Guy quotes what appears to be a well authenticated case, reported by Outrepont. A young woman, who had always been regular, menstruated as usual ten days after her marriage, in a fortnight, she had repeated attacks of vomiting, faintness and other signs of pregnancy. The menses did not come on, she quickened twenty weeks after the last menstruation, and five weeks later was delivered of a boy who breathed immediately on being born. He measured thirteen and a half inches, weighed one and a half pounds. The body was wrinkled, covered with lanugo ; the limbs were extremely small in proportion to the trunk and were kept constantly bent as in the fœtal position. The nails were like folds of skin ; the pupillary membrane was entire. He slept almost constantly, whined but could not cry ; he was insensitive to light and sound. Urine was first passed on the seventh day, and the bowels were moved on the ninth day. By great care he was reared. His testicles descended when he was eighteen months old, and at eleven years he had the appearance of a child of seven or eight.

DURATION OF PREGNANCY.

It is impossible in the human subject to fix the exact duration of pregnancy. The data generally used to fix the time of delivery are the cessation of the menses and quickening. Neither of these factors gives the exact date of conception ; the menses may cease from various causes and may continue after conception has occurred. The date of quickening varies much in different women.

The generally accepted duration of pregnancy is 280 days ; this period has been fixed, partly by the average results of a large number of cases, and partly from the records of cases in which conception followed a single coitus. It may be pointed out that fertilization of the ovum does not necessarily occur immediately after intercourse ; it may not happen for several days, during which the spermatozoa retain their vitality.

According to section 112 of the Indian Evidence Act :—" The fact that any person was born during the continuance of a valid marriage between his mother and any man, or within two hundred and eighty days after its dissolution, the mother remaining unmarried, shall be conclusive proof that he is the legitimate son of the man, unless it can be shown that the parties to the marriage had no access to each other at any time when he could have been begotten."

The law of India fixes two hundred and eighty days as the normal period of gestation, but the fact that a child is born more than two hundred and eighty days after the dissolution of his mother's marriage, or after the parties of the marriage had access to each other, does not make him illegitimate, but his legitimacy may be questioned on that ground.

Most obstetricians hold that the period of 280 days may be exceeded ; on the other hand, the child may attain to maturity in less than the usual period. From the cases given by obstetric physicians it appears that the average duration of pregnancy is 280 days, it may vary from 240 to 320. Meadows reported a case in which gestation was prolonged to 320 days ; Sir James Simpson, one of 313 days. Merriman and Reid tabulated 650 cases, among which in 81 the duration was from 288 to 294 days, in 39 from 295 to 301 days, in 13 from 302 to 308 days and in 6 from 309 to 315 days.

There is reason to believe that pregnancy may possibly be sometimes prolonged to the equivalent of ten menstrual periods instead of nine or to about 308 days. For cases have been recorded in which labour pains have come on at the expected time, but have passed off again, and have not recurred until four weeks later, while the child when born has been of unusual size and weight. In any medico-legal case, the fact of a child having been of unusual size at birth would be evidence in favour of the possibility of the pregnancy having been unusually protracted, although it is also possible that the child might be unusually small at full term, and therefore not larger than usual when born at a later period (Galabin's Midwifery).

In Scotland and in France the legal limit of pregnancy is fixed at 300 days ; in Prussia, 302 days. In England and America, no absolute limit is laid down, each case is judged on its merits.

Superfœtation.

Superfœtation is the term applied to the fertilization of an ovum belonging to another period of ovulation, during the time the uterus contains a fertilized ovum of a previous ovulation, which has been developing for a month or longer. It must not be confounded with superfecundation or the fertilization of two ova belonging to the same period of ovulation by two acts of intercourse.

There has been much discussion as to the possibility of superfœtation ; many authorities hold that it is impossible, and that the cases in which it is believed to have occurred are susceptible of satisfactory explanation on other and simpler grounds. Women have given birth to twins of apparently unequal development. This may be due to one of the children having received a smaller quantity of blood than the other. In other cases where two children, both fully mature, have been born within a few months of each other, it is probable that the uterus was double and conception occurred in each side at different periods.

It must be admitted that occasionally menstruation and presumably ovulation continue after conception, and as the decidua vera and reflexa do not come in contact and obliterate the decidual cavity until the fourth month of pregnancy, the possibility of the spermatozoa entering the uterus and fertilizing an ovum cannot be denied. At the same time, it cannot be said that the cases of supposed superfœtation recorded are inexplicable in other ways.

CHAPTER XXII.

INFANTICIDE.

In medical jurisprudence the term infanticide is applied to the homicide of a new-born child; the law, both in India and in England, makes no distinction between the murder of a new-born child and of an adult, the crime comes under the same sections of the Penal Code; but there is this difference, the law assumes that every child is born dead until the contrary is proved, consequently in cases of the alleged homicide of a new-born infant proof of its having been born alive is required.

It is necessary to inquire into the meaning of "live birth." According to explanation 3 of section 299 of the Indian Penal Code: "The causing of the death of a child in the mother's womb is not homicide. But it may amount to culpable homicide to cause the death of a living child, if any part of that child has been brought forth, though the child may not have breathed or been completely born." The law in England is different; the entire child must be actually born into the world in a living state, but it is immaterial whether the umbilical cord has been divided or not. According to English law, if a child, injured in the womb or before complete birth, be born alive and die from the injuries, it may be murder in the person who caused them. In Indian law, the doing of an act with the intention of preventing a child from being born alive, or of causing it to die after its birth is a special offence provided for in section 315 of the Indian Penal Code. (Quoted in the account of abortion.)

In cases of alleged infanticide, the medical jurist having examined the body of the child, will be asked to give his opinion on the following questions:—Was the child born alive? The question may be worded and according to Indian law should be worded:—Was the child alive when any part of it had been brought forth; or in England, when completely born? If born alive, what was the cause of the death?

There are various other points which the medical jurist must inquire into, the degree of maturity of the child, its capacity for separate existence; and if the accused is suspected to be the mother of the child, she may be examined for signs of recent delivery, but only if she gives her consent freely.

In the absence of eye-witnesses the most important evidence of live birth available, is the condition of the lungs. Before respiration these organs are devoid of air, and as a rule, a child breathes for the first time only after it has been completely born.

There are exceptional cases of children having breathed and cried while still in the womb (vagitus uterinum), or in the vagina (vagitus vaginalis) but in all these cases, air had been admitted by the dilatation of the passages caused by the introduction of the hand of an obstetrician, or of the forceps or other instrument; more frequently, a child has been observed to breathe and cry when the head was born, though the body still remained within the maternal passages.

Respiration produces changes in the volume, colour, consistence, and specific gravity of the lungs. In a child that has not breathed, the lungs are small, lie at the back of the chest, along the vertebral column, their anterior edges reach to about the middle of the ribs. The front part of the diaphragm and the whole of the pericardium are uncovered. The lungs have a uniform colour, there is no marbling. The colour is generally a livid red, somewhat darker at the posterior dependent portion. The lungs have the consistency of liver, are solid, and do not crepitate. On section they present a compact structure, and very little blood exudes. They sink in water.

After complete respiration, the lungs are inflated, their volume is increased, they fill the thorax, completely cover the diaphragm and overlap the greater portion of the pericardium. The colour is pinkish or bright red, marbled, considerably darker in the dependent portions. The colour varies, it depends on the state of the blood, if the child after breathing freely dies of asphyxia, the lungs will have a dark or very dark colour.

The lungs are crepitant on pressure; if the surface be examined with a magnifying glass, the outline of the air vesicles can be seen, they may be visible to the naked eye.

On section, the tissue of the lungs is resistant, tough, the cut surface is marbled, and on pressure blood mixed with air exudes. The marbled appearance is due to the filled state of the larger blood-vessels. Before respiration, the lungs receive only a small quantity of blood, sufficient for their nutrition ; after respiration, the pulmonary circulation is established, and they contain much more, consequently their weight is greater and bears a higher ratio to the weight of the entire body. Plouquet suggested that as in the fœtal state the lungs form about one-seventieth of the body weight and after respiration one-thirty-fifth, the difference in ratio would be a test of respiration. Further investigation showed that the ratio, before and after respiration, is subject to very great variation, and the test is valueless.

Before respiration, the lungs are small, solid, compact, liver-like, and sink in water ; after respiration, they are greatly increased in volume, filled with air, the specific gravity is diminished, and they float in water ; the difference in the specific gravity is the best test of respiration. The Hydrostatic test is carried out in the following manner :—When the abdomen is opened, the position of the diaphragm should be noted at once ; before respiration the highest point is opposite the 4th rib, after respiration at the 6th or 7th rib. Having opened the thorax and noted the position and appearance of the lungs, the pericardium may be divided, the heart chambers examined. A ligature may be placed round the lower part of the trachea, which with the vessels of the neck is then divided above the ligature, the thoracic organs, lungs, heart and thymus gland, are removed in one mass and placed in a vessel of clean water. A glass jar, containing about a foot of water, is best, as the transparent sides allow the air bubbles, pressed out of pieces of lung held under water, to be seen. If respiration has occurred, the lungs float and sustain the heart and thymus on the surface of the water ; one lung may be detached, the remaining lung if well expanded, will still support the heart and thymus. The lungs are next divided, each lobe being cut into five or six pieces, and the buoyancy of each portion tested ; after which the pieces are subjected to pressure and again put into water. If the lungs were expanded by respiration, the air cannot be expelled from them by pressure, unless the force is so great as to absolutely disintegrate the tissue. I may point out that pieces of respired lung may be pressed with the whole weight of the body, without losing their buoyancy.

If the lungs float under all the conditions of the test above described, the medical jurist is justified in giving a positive opinion that the child breathed, and he can also state that the child was born alive. It is true that under the circumstances previously mentioned, a child may breathe and cry while still within the mother's womb, but the quantity of air reaching the lungs can only be small and the respiratory movements cannot take place with the freedom necessary to draw air into every part. Respiration when the child's head has been born, could also only be feeble and insufficient to completely expand the lungs; moreover, according to Indian law a child is "in being" when any portion of it has been brought forth.

Artificial inflation has been put forward as a possible cause of an expanded condition of the lungs. As a matter of fact, artificial inflation of the lungs of a still-born child, even when attempted with great care and by a skilled person, has seldom resulted in more than a very partial expansion, accompanied, as a rule, by rupture of the lung tissue and escape of the air beneath the pleura. Inflation may be attempted by blowing into the child's mouth, or by means of a tube inserted into the opening of the larynx. The result of the first method is that most of the air passes into the stomach and intestines, very little finds its way into the trachea; and the second procedure is almost certain to cause rupture of the air cells. Artificial inflation may be attempted by moving the chest walls, Sylvester's or Howard's method for resuscitating the apparently drowned, or by swinging the body. It is said that in a few experiments by the last named method, the lungs were sufficiently expanded to comply with the hydrostatic test. Such lungs would differ from those expanded by natural respiration, in the uniformity of their colour, the absence of marbling, and the very scanty quantity of blood in them.

It may also be pointed out that it is most improbable that any person should attempt to inflate the lungs of a still born child. What would be the object? It is most unlikely that the mother secretly confined, and in all probability only too pleased that her child was dead, would attempt to artificially inflate its lungs.

Putrefaction is of much greater importance, and more likely to interfere with the application of the hydrostatic test. The medical jurist in India seldom has a perfectly fresh corpse to examine in a case of suspected or alleged infanticide. During eight years as Police Surgeon in Calcutta, only in one case of infanticide, did I find the body quite free from decomposition. I may add that I have examined several cases of infanticide. In most of them the body was discovered in a back lane or in a rubbish heap ; in none did the police investigation result in obtaining evidence or even in discovering the mother.

As the result of putrefaction, gas is formed in the lung tissue, and in a short time sufficient is produced to cause the lungs to float in water, even to sustain the heart and thymus. The presence of putrefaction is indicated by the appearance of the body generally, and in the lungs by the discoloration of the tissues from the decomposing blood, and the formation of blebs beneath the pleura and in the tissue. The blebs vary in size ; they may be as large as a grape or even larger ; they may occur in clusters, irregularly distributed over the surface. If the blebs are pricked, they collapse ; they may be moved beneath the pleura by pressure.

To determine whether the buoyancy of the lungs is due to putrefaction, the following test should be made : The lungs are cut into pieces, some of the pieces are held under water and squeezed, putrefactive gases escape in the form of large bubbles of different sizes, and when the whole of the gas is expelled, the lung will sink. The other pieces are one by one subjected to firm pressure, and put into water. If they no longer float the buoyancy was due to the presence of putrefactive gases.

As mentioned, in India, in cases of infanticide, the body is generally putrid when examined. The hydrostatic test can be applied unless the decomposition of the lung tissue is so far advanced that pressure reduces it to a structureless pulp. If less advanced, the test is carried out in the usual manner. Pressure removes the gases of putrefaction but not the air of respiration. A piece of the lung squeezed under water gives off the large irregular sized bubbles of putrefactive gases which are soon completely expelled, but the stream of fine air bubbles continues and no pressure, short of destruction, will completely remove the air introduced by respiration.

As already stated if the lungs are expanded so that every part continues to float after pressure, the child has breathed, and further, has been born alive. The first inspiratory effort cannot fill the lungs with air. To effect this, respiration must be established for some time. It is impossible to fix a time, it probably varies. A strong robust infant begins to breathe immediately after birth. The first inspirations are of an irregular dyspnœic type, but they very quickly become rhythmical. Air is drawn into the lungs, and the air-vesicles in every part are quickly expanded to an extent sufficient to cause the organs to float even when weighted with the heart and thymus, but complete expansion, or distention of the air-vesicles to their fullest capacity, requires several hours or longer. In a weakly child or one immature, the respiratory efforts are feeble, and not infrequently do not commence for a short time after birth. Expansion of the lungs takes longer than in a robust infant and if death occurs soon after birth the greater portion may still be in the fœtal condition. It is not uncommon to find in children who have lived some days considerable areas of the lungs unexpanded.

If no air is found in the lungs, the usual cause is that the child was still-born, but it may have been born alive and have died before respiration had occurred ; or the entrance of air may have been prevented ; there is a third possibility, air may have entered, though none is found after death.

A child born before the 180th day of gestation, and most of those born even a month later, dies without breathing, owing to the undeveloped condition of the respiratory mechanism, centre and muscles. An infant of full term may not breathe for a short time after birth ; this may be due to the blood supply through the placenta not having ceased, the condition is one of apnœa, the oxygenated blood does not stimulate the respiratory centre. More often, children are born in an asphyxiated condition, brought about by interference with the placental circulation during labour, death may occur if delivery is delayed, or the child is born apparently dead but can be resuscitated by treatment.

The respiratory movements may take place after birth, but the entrance of air may be prevented by the mouth and nostrils being covered by the membranes, as when the child is born in the intact membranes, or with its face covered. The air passage may be blocked by material drawn into it while the child is in the uterus ; if the placental circulation is interrupted, the child's blood becomes venous, its respiratory centre is stimulated and the movements of respiration occur, with the result that liquor amnii is drawn into the air passage. In these cases, the meconium may be discharged and, mixing with the liquor amnii, may be drawn into the bronchi.

It is remarkable that in a child born in a state of profound asphyxia and which makes no attempt to breathe, the heart's action continues for a much longer period than in asphyxia of adults. In asphyxiated infants, the herrt has acted for half an hour or longer. Von Hofmann mentions a case, recorded by Maschka, of a new born child put aside as dead, in which the heart was audible after 20 hours.

The third class of cases, children have survived for hours, breathing in a normal manner though feebly, yet on post-mortem examination, no air has been found in the lungs. It must be understood that these are not cases of pathological consolidation of the lungs, or of pleural effusion. The lungs presented no sign of disease, they were in the unexpanded fœtal condition. Various explanations to account for this extraordinary condition have been put forward. One is that in these children the air did not pass beyond the bronchi, through the walls of which and of the trachea, aeration of the blood, sufficient for the needs of the infant, took place.

Ungar held that the air which entered the alveoli may be entirely absorbed after respiration has ceased, provided the circulation continues ; that the heart in new-born children may go on acting long after stoppage of the respiration is an undoubted fact.

Another view is that in these cases the inspiratory act fails before expiration which is effected mainly by the recoil of the elastic lung tissue, and thus the quantity of air taken in by a feeble inspiration may be smaller than the amount expelled by the less enfeebled expiration, and in this manner the lungs may be completely emptied.

It is evident that an unexpanded airless condition of the lungs is not an absolute proof of still-birth ; nevertheless, if this condition exists and there is no direct evidence that the child was born alive, the medical jurist is justified in coming to the conclusion that the child was born dead. Of course in forming an opinion, the state of the body generally, all signs of disease and of the cause of death, will be carefully considered.

There is another sign of live-birth which is of considerable value. When a child is born alive and breathing begins, the air taken in by the first inspiration is to a considerable extent swallowed and makes its way into the stomach and upper portion of the small intestine and gradually into the whole of the intestinal canal. It may be mentioned that in attempts to resuscitate a still-born infant by blowing into its mouth, nearly all the air passes into the stomach and intestines, and if the efforts are continued air may escape from the anus.

There is no air in the stomach and intestines of unborn children. To determine the presence of air in the stomach and intestines, these organs are carefully ligatured, removed and their buoyancy tested in water. This test is destroyed by putrefaction and for this reason is seldom available in India.

In examining the body of a new-born child, the state of the bladder and large intestine should be noted. When a child is born alive, in most cases, urine and meconium are voided within a few minutes of birth. An empty condition of the bladder and lower portion of the large gut is of some corroborative value, but nothing more ; they may be emptied while the child is in the uterus, especially if, from interference with the placental circulation, the child is at all asphyxiated.

The condition of the middle ear has been considered an indication of the state of the child at birth ; during fœtal life, it is filled with gelatinous matter which, after birth, is displaced by air. The test is of no value, the gelatinous matter begins to disappear weeks before birth ; moreover the examination of the state of the cavity is very difficult.

If, from the examination of the child's body, the medical jurist concludes that it was born alive, he has next to determine how long it survived and the cause of death. As to the first question, the answer can be only approximate ; the factors available are, the shedding of the epidermis, the state of the caput succedaneum, the changes in the umbilical cord, the condition of the foramen ovale and ductus arteriosus, and of the stomach and intestines.

The epidermis begins to exfoliate during the first day and the process is completed in about a week. The caput succedaneum or serous effusion of that part of the scalp which presents and projects into the os during delivery generally disappears within twenty-four to forty-eight hours.

Changes in the umbilical cord begin to be apparent in about twenty-four hours ; the stump dries up from the extremity towards the umbilicus, it is dark and shrivelled by the second or third day, it gradually assumes a horny consistency, and drops off about the fifth or sixth day. Separation is effected by inflammation and the formation of granulation tissue ; when the remains of the cord fall off the granulating surface is healed in a few days. The obliteration of the umbilical vessels takes place in five or six days, the arteries are closed much sooner than the vein.

Closure of the foramen ovale and ductus arteriosus is also effected in five or six days.

The presence of food in the stomach, the complete evacuation of the meconium, and the presence of fæcal matter in the intestines, indicate survival for some days.

THE CAUSE OF DEATH OF THE CHILD.

In suspected or alleged infanticide, the essential question to be decided is the cause of the child's death. Was it due to natural causes, disease, or faults of development, or to accident, or to acts of a criminal character ? And, if to the latter, were they committed before or after birth ?

NATURAL CAUSES.

During intra-uterine existence, the fœtus may die from many different diseases, either affecting it directly, or involving the placenta, or from morbid conditions of the mother. It may die from faults of development, or its death may be due to inherent deficiency of vitality.

Of all the diseases to which the fœtus is liable, syphilis is the most common cause of death in utero, or soon after birth.

Death in the early stages of development does not concern us here, but syphilis also causes death in the later stages, and many syphilitic children die soon after birth. The signs of syphilis are generally easily recognised. The infant presents an unhealthy, shrivelled, and often senile, appearance. The skin is blotchy and may exhibit copper coloured patches. Bullæ are often found on the hands and feet and other parts. In the lungs, areas of a dense white colour are seen, airless even though the child breathed. The whole of the lungs may be involved. The condition is due to a diffused growth of connective tissue; it was called by Virchow, white hepatization. The liver and other organs exhibit a similar diffused hyperplasia of connective tissue. Gummata may also be found. In the bones, syphilis produces a characteristic lesion, an osteochrondritis, affecting the junction of the shaft with the epiphysis in the long bones. The lower end of the femur is most often affected. Death of the child may be due to disease of the heart, or brain, or other organs, to rickets, rheumatism, leukæmia, malignant disease; or from the specific infectious diseases, small pox, measles, scarlet fever, etc., transmitted from the mother. Any febrile condition affecting the mother may cause the death of the fœtus.

Children who die during gestation, especially from natural causes, are usually retained for some days or even for weeks. In the latter case, the body is macerated; putrefaction does not occur in the fœtus within the intact membranes. Maceration is a process of softening in the liquor amnii. The cuticle becomes detached, the cutis and tissues are stained brownish red by altered hæmoglobin. The tissues undergo a kind of fatty degeneration, the bones are loosened. The whole body is reduced to a pulpy condition, and can be squeezed into any shape. There is a disagreeable odour but not that of putrefaction. If the membranes are ruptured and air and germs get admission, putrefaction takes place rapidly.

Disease of the placenta causes death of the fœtus, so does separation which may be caused by a fall or a blow.

During parturition, the child may die from various causes; statistics show that of dead-born children, more than half die during delivery. The danger is the greater in those cases in which a suspicion of infanticide is likely to arise, as the mother is generally confined in secret and without assistance. The causes of death during parturition are premature interruption of the placental circulation, and pressure on the child's head.

One of the commonest causes of still-birth is asphyxia, induced by premature interruption of the placental circulation. When the child is in the uterus, its blood is oxygenated in the placenta and its own respiratory mechanism is quiescent. If by any means the supply of oxygen is cut off, the resulting venous condition of the child's blood stimulates its respiratory centre, and respiratory movements take place. If the child is within the uterus, the fluid in which it lies is drawn through the mouth and nostrils into the trachea and bronchi. Deprived of oxygen, death occurs unless the child is quickly delivered, and even after birth, the presence of fluid in the trachea and bronchi may prevent the entrance of air. The post-mortem appearances in these cases are distinctive, liquor amnii, vernix caseosa, and, often, particles of meconium, are found in the trachea and bronchi, and also in the stomach. The lungs are congested, the respiratory efforts cause the establishment of the pulmonary circulation; petechial hæmorrhages, generally numerous and well marked, are found beneath the pleura and pericardium and on the thymus gland. If the mouth and nostrils were closed by the membranes or by being pressed against the uterus, no fluid can enter and the trachea and bronchi are empty, the other signs are present. A cyanosed condition of the face, petechiæ and injection of the conjunctivæ, are also generally present in cases of antenatal asphyxia.

It is of importance to note that the child may be born alive and may breathe, notwithstanding the presence of liquor amnii in the trachea and bronchi. In the body of an infant examined in 1894, the lungs were sufficiently expanded to support the heart and thymus gland, though not on the surface of the water; they were crepitant and contained much blood. Petechial hæmorhages were numerous on the lungs, heart and thymus. In the bronchi there was fluid, containing meconium and flakes of vernix caseosa. Similar fluid was present in the stomach. There was no sign of violence on any part of the body.

It is possible that this infant, of which no history was available, was drowned in the liquor amnii after birth.

The common causes of interference with the placental circulation are pressure on the cord, owing to prolapse, or to being round the child's neck; separation of the placenta which may be due to its position, or to violence, accidental or intentional.

During labour, the child's head is subjected to compression which diminishes its size and alters in shape. The diminution in size is due to portion of the blood being pressed into other parts of the body and to the displacement of the cerebro-spinal fluid which is driven into the spinal canal. The alteration in shape is effected by the movements and overlapping of the cranial bones; the frontal and occipital pass beneath the parietal bones, and that parietal which is subjected to greater pressure passes beneath the other. These changes throw the scalp into folds, and that portion, which projects into the os and is unsupported, becomes filled with serous effusion, causing a swelling known as the caput succedaneum. In breech deliveries, the caput succedaneum forms on the buttocks and genitals. Its position is an indication of the presentation, its presence shows that parturition lasted some time; it is not formed in precipitate labour. Besides a serous effusion, petechial hæmorrhages are commonly found in the scalp, and in some cases, large effusions of blood are formed beneath the pericranium, they are due to rupture of vessels, caused by the movements of the bones. The formation of a caput succedaneum and of petechial hæmorrhages or larger blood effusions shows that the child was alive during parturition. Blows on the head after birth will cause effusions of blood; marks of injury to the surface will, as a rule, enable them to be distinguished from the effusions caused by compression.

If labour is prolonged, and especially, if the child's head is subjected to excessive compression, serious or fatal hæmorrhage may occur from rupture of the meningeal vessels. The bones of the head may be bent or fractured. Extravasations of blood may occur at the base of the brain, along the spine, in the pleura, and in the peritoneum.

Fatal injuries from compression are more likely to occur when the liquor amnii has escaped early, and in cases where the uterus is in a condition of continuous or tetanic contraction.

Death of the Child after Birth.

The child may die from immaturity; the viable age is generally taken to be six months, but very few children of this period survive more than a few minutes.

Children of full term may die after birth from inability to sustain a separate existence, and the post-mortem examination may show no cause of death.

The child may die after birth from injuries sustained during parturition. These cases require very careful examination, the injuries may be caused by uterine compression, or by efforts of the mother or others to assist delivery.

Precipitate labour may be fatal to the child, cases of sudden delivery have occurred among primiparous and multiparous women. Labour may be precipitate when the expulsive force is unusually great, or when the child is small, or when the maternal passage is large and offers slight resistance. Woman have been suddenly delivered when standing upright, when sitting at stool, when in bed, and under other circumstances. In such cases, the child may die from injuries due to falling head foremost on a hard floor, or if the woman was at stool, death may result from drowning, or it may die from hæmorrhage from the torn cord, or, from neglect, the woman, owing to the shock produced by the sudden delivery, may faint, or be rendered incapable of attending to the infant.

The plea of precipitate labour and accidental death of the child is often put forward in cases of infanticide, but it will generally be found that the statement of the woman is inconsistent with the circumstances and the post-mortem appearances of the infant. In all such cases the examination of the child's body requires great care. If delivery occurred in the upright posture, the umbilical cord will usually be torn. It generally tears close to the body of the child, or at the navel. The question whether the cord was torn or cut is decided by the appearance of the divided ends. If cut, the surface is smooth, transverse, or oblique, according to the direction of the cutting instrument. If torn, the edges are ragged, frequently ragged flaps of the covering of the cord project from one side, the vessels are generally torn at a different level, the arteries may protrude. If the cord is fresh, it is generally easy to distinguish a cut from a torn end, but putrefaction or drying destroys the appearances.

Fractures of the skull caused by precipitate delivery generally occur in the parietal bones, and usually take the form of multiple fissures in the direction of the ossifying radii. In cases of infanticide by blows on the head, complete smashing of the skull is almost invariably found.

Injuries to the head caused by precipitate labour are seldom immediately fatal, the child lives and breathes for some time and the lungs may be fully distended with air. If the child was born while the mother was sitting at stool and fell into fluid, no air may be found in its lungs, the trachea and bronchi will be filled with the fluid, but unless the face and nostrils were immersed at once air will get into the lungs.

Hæmorrhage from a torn cord is rarely great, the blood coagulates in the ragged tissues and the bleeding is stopped; even when the cord is cut, hæmorrhage may not be great owing to the contraction of the arteries. In fatal hœmorrhage from the cord, it is probable that the infant was, in most cases, a bleeder.

DEATH OF THE CHILD FROM CRIMINAL ACTS.

The commonest means adopted for killing new-born infants is by causing asphyxia in some way. Closure of the mouth and nostrils, by the hand, or with a cloth, is one method. Marks of the fingers and nails will be found on the cheeks and lips, bruises will also be present. But bruises and scratches may be due to attempts of the mother, or others, to assist delivery, even fracture of the lower jaw has been caused in this way.

Lyon mentions drawing of the membranes tightly over the child's head; no sign of injury would be caused and if the procedure was adopted before the child had breathed, the case would pass for one of intra-uterine suffocation. The introduction of the finger into the mouth and throat is sometimes practised; abrasions of the pharynx are generally present. The pharynx may be plugged with a piece of cloth; in one case, a rag folded in a triangular shape was found sticking into the larynx, the body was very putrid and the examination of the lungs gave indefinite results. It seemed probable that the child had not breathed. The mouth and throat may be plugged with mud or cowdung, or the child may be suffocated by burying its face in these or other substances.

The child may be killed by throttling. In the following case throttling was combined with general violence. The body of a new-born female infant of full term; placenta attached, no sign of a ligature or of injury on the cord. On the front of the neck, low down, there were small abrasions, three on the right side, one on the left; they measured from a fourth to three-eighths of an inch in length and were encrusted with dried blood. There was a small effusion of blood in the tissues beneath. The lungs were expanded, crepitant, mottled all over with large and small sub-pleural hæmorrhages, the substance congested. The usual test showed that respiration had taken place. The surface of the heart and thymus was studded with hæmorrhages, similar to those found in the lungs. The right side of the heart was full of blood, the left side was empty. There was an extensive deep rupture of the liver, the abdomen was full of blood. The bladder contained urine and the large intestine was full of meconiun. There were large hæmorrhages beneath the scalp, the skull was fractured through the left temporal and occipital bones. Blood was extravasated over the brain and in the ventricles.

Strangulation by a ligature is a common mode of infanticide. The tissues of a new-born child are delicate and easily injured, consequently even a ligature of soft cloth will produce a mark, and not infrequently the pattern will be impressed on the skin. This is also seen when a cloth is forcibly pressed over the mouth and nostrils. In a strangulation mark, the surface is abraded, blood stained; hard and parchment-like when dry. The tissues beneath are injured, filled with extravasated blood. Very extensive injuries to the muscles and deeper structures may be found. In cases of infanticide by strangulation, the usual defence is that the death of the child was caused by pressure of the umbilical cord, accidentally coiled round the neck. The umbilical cord is not infrequently found round the neck, generally in two or three turns, but it rarely leaves any mark on the neck, even in those cases where it has had to be divided to permit the completion of delivery. Should a mark be caused, it will be faint, the surface soft, smooth, not abraded, the tissues beneath uninjured.

Moreover, if the child was strangled within the uterus, the lungs would be unexpanded. The danger to the child from the umbilical cord round the neck is of interference with the placental circulation and intrauterine asphyxia.

The umbilical cord has been used as a ligature to strangle the infant. The mark caused would show no abrasion of the surface, but there would be extravasations of blood in the tissues beneath. The cord would show marks of having been grasped.

Pressure on the chest is another means of infanticide; bruises and finger marks are found on the skin and tissues. Children are not infrequently killed by smothering, a blanket or other cloth is thrown over the child. No external marks are found. Infanticide by drowning is common, the new-born child is thrown into a well or tank. The usual post-mortem appearances of drowning are found.

Fractures of the skull from homicidal violence are almost invariably very extensive, differing in this from the fractures which may, occasionally, be produced by compression of the head. It is very improbable that congenital fissures of the bones of the skull could be mistaken for fractures the result of violence; congenital fissures have rounded edges, the adjoining portions of bone are thin. If the bone be removed and held up to the light, the absence of ossification will be seen. Congenital fissures are generally numerous and may be accompanied by defective ossification in the bones of the limbs.

Infanticide by wounding is not common, but, not infrequently, the child, killed by strangulation or in some other manner, is cut into pieces immediately after death to facilitate disposal of the body. Wounds are sometimes found in unusual situations. Infanticide by thrusting a needle into the brain through a fontanelle or an orbit or through the temple has been recorded; also cases of needle wounds of the spine at the nape of the neck, and of the heart.

Infanticide by general violence is also met with; the signs vary, as a rule, extensive injuries are inflicted.

In India, there is a general belief that infanticide by opium is common; this may be so in the opium-growing districts but it does not appear to be the case in Calcutta. It is said the opium is sometimes administered by smearing the mother's nipples with the drug. The juice of madar, oleander, and other poisonous plants, is sometimes used to kill new-born children.

The death of a new-born child may be caused by neglect, and the absence of assistance during labour, the mother being for the time incapable of attending to the child. There is no doubt a woman may pass through the whole period of gestation up to delivery without being aware of her condition. In the "Glasgow Medical Journal" for April 1903, Dr. Jones of Ibrox reports the case of a woman who was still suckling her first boy, sixteen months old, and was not aware that she was pregnant. When pains occurred she thought they were due to wind, and until the infant announced his arrival she did not realize that she had been pregnant.

New-born children are occasionally got rid of by depositing them in a back street or some similar place. In one case a living child was found wrapped up in a cloth ; it died shortly after. On post-mortem examination, no definite cause of death could be discovered.

CHAPTER XXIII.

INSANITY.

There is no subject in medical jurisprudence which requires greater care and professional knowledge than the investigation of insanity.

The mental condition of an individual may be the subject of inquiry under various circumstances.

The perpetrator of a crime may be defended on the plea of irresponsibility for his act, owing to insanity. The capacity of a person to take care of himself and to safeguard his interests may be questioned on the ground of mental disease. A will may be disputed on the plea that at the time of making it, the testator was insane and, on that account, unfit to dispose of his property. A person, who entered on a contract, may subsequently seek to repudiate it, on the plea that at the time of entering on it he was insane. In the interval between committing a crime and standing his trial, the perpetrator may have become insane and a medical jurist may be called to express an opinion as to the fitness of the accused to stand his trial and make his defence.

Before entering on the consideration of the legal relations of insanity, it is customary, in works on medical jurisprudence, to describe the different manifestations of disease of the mind, though, necessarily, the descriptions are brief, and should be supplemented by a study of special treatises on the subject.

According to some writers, the mind should be considered apart from the brain, but evidence is very strong and rapidly increasing that mind and brain cannot be separated. Whatever else the mind may be, it is the manifestation of the functional activity of certain elements of the brain.

The development of the mind is brought about by the action of sensory impressions conveyed to the brain from without, as Leibnitz has said: "There can be nothing in the intellect which has not reached it through the senses." At first the child exhibits no sign of mind, but gradually as the result of impressions conveyed by the senses, the special elements of the brain become endowed with mental functions. The extent of the development depends on the inherent qualities of the brain elements and on the training to which they are subjected ; both these factors present infinite variety, hence no two minds are in all respects exactly alike. It follows that there can be no standard mind, and when we investigate the mind of an individual, we should use his own normal mental state as the standard with which to compare his present condition. A man is accounted sane so long as there is no serious departure from the normal operations of his mind. It may be easy to recognise the alteration, or the inquiry may be attended with the greatest difficulty, especially when the change is confined to one portion of the mind.

The normal brain possesses the capacity for developing, under suitable training, the group of faculties which make up the mind. The first movements of a child are unaccompanied by consciousness, but as the result of stimulation produced by impressions conveyed to the brain from without, memory, conciousness and ideas are developed ; gradually the child exhibits mental activity, and later the power of controlling its desires. The capacity for mental development, possessed by individuals, exhibits the widest possible differences, and as training is equally diverse, no two minds are in every respect exactly alike. It follows that the power of distinguishing right from wrong, legal from illegal acts, and of controlling the desires and guiding the conduct in accordance with law and morals, is not possessed by all persons in an equal degree.

The law presumes every person, who has reached a certain age, possesses mental powers sufficient to render him responsible for his acts. It is evident that to fulfil his legal obligations, he must have a certain amount of intelligence, to distinguish right from wrong, legal from illegal acts, but the presence of intelligence alone is not sufficient to preserve the individual from transgressing the law. It must be accompanied by the power to control the desires and actions. It will be seen in the account of diseases of the mind and abnormalities of mental development that in some individuals the controlling or moral faculty may be absent while the intellect is intact.

THE CLASSIFICATION OF MIND DISEASES.

It is evident from the foregoing sketch of the development of the mind that absence or defect in the brain elements will necessarily produce absence or defect of the mind. The same result will follow from destruction or damage of the brain elements before they have acquired their functional activity. This condition of non-development is called AMENTIA which includes, not only total absence of mind as the term implies, but also conditions of imperfect development.

The mind, having reached its full development, may undergo degeneration, the result of changes in the brain. This is called DEMENTIA.

THE FUNCTIONS of the brain after its development may be TEMPORARILY OF PERMANENTLY DERANGED. Under this division are included mania, melancholia, delusional insanity and other manifestations of disordered mental functions.

In describing the different forms of mental disease certain terms will be repeatedly used, and as they are not employed by all authors to convey the same meaning, it is advisable to define them.

ILLUSION is the word which will be applied to an erroneous perception of an external object; for example, on entering a room, a garment hung on the wall may be mistaken for the figure of a man. This is an illusion of sight, it has an objective foundation, the garment, which was erroneously perceived by the visual sense.

Illusions of sight are the most common among insanes; a very frequent illusion is that of identity, mistaking one person for another, or one object for another totally different. In acute mania, nearly everything seen is misinterpreted.

Illusions of hearing also occur, as when a sound is misinterpreted, the cry of one animal for that of another. Illusions of smell and taste are less common. Visceral illusions or the misinterpretation of bodily sensations are very frequent; pain or abnormal sensation in the abdomen may, in an insane, give rise to the belief that a snake or a rat is gnawing his vitals.

Illusions occur to sane people but the judgment being intact the misinterpretation of the senses is corrected; in the insane the judgment is involved, the illusions are accepted and become delusions.

HALLUCINATIONS are false perceptions without a material basis; they are purely subjective. Their origin is probably due to a condition of excitability of the cortical perceptive centres; an hallucination may occur to a sane person though its origin is due to an abnormal state, but in the sane the falseness of the perception is recognised by the judgment. A sane man whose leg has been amputated may occasionally have sensations referable to the absent leg. He knows the sensations are false.

Hallucinations occur very frequently in insanes, the commonest are those of hearing. They often exist at the beginning of the illness and for a time the patient may recognize their unreality, but they gradually force themselves on his consciousness, and he accepts them as real. The patient hears voices, and people speaking about him, generally in a disagreeable way, threats, abuse, commands. In some cases the voices are, after a time or even from the beginning, identified with certain individuals; hallucinations of this type are very dangerous, and account for most of the cases of sudden assaults by insanes.

Sometimes the patient is conscious of an internal voice which directs him to do certain acts. In some cases, the patient complains that his thoughts are understood, and he hears them repeated as soon as formed.

HALLUCINATIONS OF SIGHT.—Among the insane hallucinations of sight are less common than those of hearing; they occur, especially, in certain toxic forms of mental derangement, acute alcoholism, intoxication by Indian hemp, datura, and other drugs, also in conditions of starvation, thirst and exhaustion.

They are generally of a disagreeable character, terrifying figures, as in delirium tremens, but in the mental derangement caused by Indian hemp, voluptuous pleasing visions are usual.

Hallucinations of taste and smell also occur. The patients complain of a disgreeable or disgusting taste in everything they eat, or of foul odours constantly present. These hallucinations may give rise to assaults, the patient connecting the annoyance with the acts of certain persons.

HALLUCINATIONS OF TOUCH, PAIN, AND MUSCULAR SENSE.—Patients complain of insects creeping over them, or of electric shocks constantly felt, or of needles being thrust into the flesh, or of being burnt. In some cases, the patient complains of the weight of his limbs, in others of their lightness.

Hallucinations connected with the genitals are of very frequent occurrence, especially in females. Obscure sensations are experienced, which may give rise to delusions of emasculation in men, or of violation in females.

Delusions.—A delusion is a false belief, the acceptance, by the judgment, as true that which is false. This definition requires further explanation, the false belief to constitute an insane delusion must be contrary to the normal habit of thought of the individual, and incompatible with his mental training. Beliefs of all kinds are largely the result of up-bringing and social conditions. The beliefs of sane people are often considered delusions by others. What we understand by an insane delusion is a perversion of the judgment which accepts as true, ideas and sensations, objective and subjective, which are incompatible with the normal working of the individual's mind. The existence of an insane delusion is proof of defect in the judgment and therefore necessarily implies a diseased state of the mind.

The origin of insane delusions occurs in many ways; they may arise from illusions or from hallucinations, as before mentioned. Some delusions originate from ideas which force themselves into the consciousness, and are gradually accepted by the judgment. In conditions of great mental excitement, every idea becomes a delusion; acute mania is characterised by fleeting delusions, produced by every suggestion that reaches the mind. In some forms of insanity, there are delusions of a fixed type, which may exist for a long time without interfering with the judgment in matters not directly connected with the delusion, but there is a tendency after a time, especially if the delusion is connected with matters of personal interest, for it to dominate the mind and control the conduct.

Lucid Interval.—This term, more used by legal writers than by medical men, originated from the belief that some forms of insanity were influenced by the moon, increasing and decreasing according to its phases; lucid intervals were believed to occur mostly between the full and change of the moon. According to some authorities, a lucid interval is a period of complete intermission of all symptoms of mental disease, a period of complete recovery. By others, it is held to be an interval of remission of symptoms, which, though greatly lessened, do not completely disappear, a period of partial recovery. According to lawyers, during a lucid interval, there is a suspension of the manifestations of insanity and a restoration of the senses to the degree required to enable the individual to know the nature of his acts, and to render him responsible for them.

AMENTIA.

All forms of defective development of the mind are included under the above heading ; it comprises idiocy in all its manifestations, and moral insanity. Imbecility is used by some authors to distinguish defective mental development manifested during childhood but not of congenital origin, here the term is applied to the slighter forms of idiocy without reference to their causation.

Idiocy.

Every degree of idiocy is observed, from complete amentia to conditions in which the mental defect can only be recognised by close examination. In the severest form the mind is totally wanting, the unfortunate individual has a vegetable organisation, he sees nothing, knows nothing, feels nothing, his existence is passive, he must be fed, clothed, guarded from heat and cold, and looked after in every way, he can do nothing for himself. Creatures of this type are of little medico-legal importance, they are incapable of any action, good or evil, legal or illegal, and the question of their responsibility cannot arise.

In the less severe and more common types of idiocy, the brain is capable of developing mental qualities upto a certain point. The results obtained in idiot schools show that even a high degree of brain defect may prove susceptible to considerable improvement. It will, however, be found that training has little effect in developing the higher qualities of mind, and that the judgment and reasoning power remain almost entirely absent. Training may be compared to the "breaking in" of an animal ; by continued patient efforts a young animal is taught to obey, to perform certain acts and even to exercise self-control to a limited extent. In a similar manner, an idiot learns to do certain things and certain qualities of the mind are gradually developed. Occasionally, an idiot possesses a surprising degree of talent in one direction, some exhibit great mechanical skill, others great power of memorizing facts or figures, or cleverness in other ways, but in all there is a want of judgment and reasoning power, self-control is weak and the passions tend, especially as the individual grows older and the restraint of discipline is relaxed, to dominate and direct his conduct. The absence of the higher qualities of the mind renders the idiot unfit for an independent life. So long as he is under discipline, he may be a harmless and even useful member of society, but if left to himself the effects of training soon disappear and he relapses into his original condition, as an animal allowed to run loose forgets its breaking in.

The experience of idiot schools shows that idiocy of congenital origin is much more susceptible to training, than the idiocy resulting from causes acting after birth.

The characteristic features of the mental organization of idiots are defective development of the higher faculties, particularly attention, comprehension initiative, and memory; and an absence of the highest faculties, judgment, will power and moral sense. There is also an alteration in the lower or animal qualities, generally, in the direction of excess, hence among idiots, gluttony, sexuality in all forms, cruelty, passionate outbursts, are frequently observed.

Congenital idiocy is generally accompanied by defective physical development, which may be extremely marked. The commonest defects are in the size and shape of the head ; in many idiots, the head is abnormally small, especially in the cranial portion, which is also usually mis-shapen ; more rarely the head is abnormally large. The mouth is often large and distorted, the jaws narrow, the teeth crowded together and defective.

The arch of the palate is high and narrow, this is considered to be one of the most constant signs of defective mental development, and may be present even in cases of slight imbecility.

The special senses are generally dull ; the eyes are often affected with cataract, distorted in shape, or retinal sensibility is below normal.

The stature is generally less than normal, and the body is often deformed. The skin may be peculiarly coarse, loose, appearing to be too large for the body, from which it hangs in folds. The muscles are generally flabby, the gait awkward; in marked cases of idiocy, there is inability to move, the feeble limbs cannot sustain the body, paralysis of muscles is not uncommon. The functions of organic life are feebly performed, circulation, respiration, and digestion are weak. The habits are untidy, dirty, often disgusting. Sexual functions are commonly absent in the severer forms of idiocy ; in imbecility they are often in excess and frequently perverted ; in adult idiots, the sexual passions may lead to assaults on women and children.

Speech is almost invariably affected, its condition may be taken as an index of the mental failure. The defects of speech vary from complete mutism to the possession of a fairly extensive vocabulary and great volubility ; a not uncommon condition is the use of a few words to express all wants ; in some cases only one or two words are employed ; in others speech is represented by inarticulate cries and animal-like sounds.

Congenital idiocy is not always accompanied by physical defect. In some cases the development of the body is normal. Clouston mentions an idiot with "an exceptionally sweet face, fine expressive eyes, wonderfully good walking and a well formed body ; and says " The face and eye of such an idiot tell lies when they thus express mind."

The causes of congenital idiocy are intemperance, consanguineous marriages, neuroses, constitutional debility and over sexual indulgence, of the parents. Intemperance is much more often the cause than the other conditions mentioned. Injury to the brain during parturition and bad health of the mother during gestation may produce idiocy. Syphilis, according to many authorities, is a factor of little importance, others place it next to intemperance.

Idiocy occurring in children born with a normal brain is the result of injury or of disease involving the brain or its membranes ; rickets, tuberculosis, chorea, convulsions, epilepsy, hydrocephalus, the sequelæ of zymotic diseases, account for most of the cases. Idiocy not infrequently manifests itself during first or second dentition, or at puberty ; at these periods, the nervous system is subjected to considerable irritation and if a tendency exists, the development of the mind may be temporarily, or permanently interfered with. The effect of puberty on the mental organization is often striking, the smart clever boy becomes dull, listless, unable to keep his place in school ; in most cases, the effect is temporary, but in some it continues, and occasionally, after a period of maniacal excitement or of melancholia, ends in dementia.

The manifestations of developmental idiocy are as varied as those of the congenital form, from which it can usually be distinguished by the history and the absence of physical malformation.

For the medical jurist, the slighter forms of idiocy, to which the terms imbecility and weak-mind are applicable, are of greater importance than the marked types of the condition. In imbecility and weak mind there are many gradations, the severer forms cannot be separated from idiocy ; in others, the individual may pass through life without the defective development of his mind attracting notice, or, what not infrequently happens, some sudden crisis brings it to view.

Imbecility and even the less pronounced forms of idiocy are seldom detected before school age. It is then noticed that the child understands slowly and with difficulty, takes a long time to learn a task and reproduces what it has learnt mechanically and in a manner which shows that it has not really understood the subject. As the child grows older, the defective condition becomes more evident. It does not keep pace with other children and remains a long time in the lower classes. The teachers gradually discover the limitations of its mind and the impossibility of getting it to comprehend abstract subjects ; in imbecility, as in idiocy, the defect is always more marked in the higher faculties.

The moral side of the mind is very defective, as shown by shameless lying, cruelty, stealing, and indecency. The controlling power is weak, and the force of the passions frequently leads to the commission of criminal acts.

In the slighter forms of imbecility, the individual is able, slowly and with many failures, to pass through his school curriculum, but the knowledge he has acquired is not real, he does not and cannot comprehend the subject which he has been taught, still he may pass through life as a useful member of society ; his acquirements enable him to fill a subordinate position in which there is no demand for the higher mental faculties, but in a position of independence, the defects of his judgment, comprehension, and will, are soon manifested. Individuals of this type are unsuccessful in their business ventures, they are incapable of sustained effort, and are constantly changing from one thing to another ; moreove, owing to the defect of the moral sense, they easily fall into criminal ways.

MORAL IDIOCY.

This term is applied to a condition of absence or defective development of the moral sense without defect of the intellect.

There has been much controversy, among alienists, as to the existence of moral idiocy as an isolated defect of the mind. Some hold that the moral sense is a distinct faculty, and, therefore, its development may be interfered with, without other faculties being involved. They compare moral idiocy to colour blindness, an isolated defect of the visual apparatus.

Many alienists maintain that what is termed the moral sense is not a separate faculty but a quality of the intellect, engendered by training ; where the intellect is defective, the moral sense is also necessarily defective, and if a child has never been taught to control its desires, it cannot be expected to conduct itself in accordance with the recognised code of morals.

Against this view, there are many striking instances of complete absence of the moral sense without any appreciable defect of intellect, and although in most cases, the intellect is not of a high type, and in many, undoubtedly defective, yet in some, intelligence above the average has been combined with extreme defect of the moral faculty. The existence of a separate moral faculty located in a special part of the brain, although at present we have no knowledge of its position, receives support from the observation of brain disease. In most cases of mental derangement, the onset of the disease is manifested by alteration in the conduct and feelings for some time before any sign of disorder of the intellect. The moral sense is the highest attribute of the human mind and the latest evolved ; in disease it is the first to suffer, and the last to be restored ; not infrequently in recovery from mental derangement, though the intellect has regained its former level, the moral sense remains permanently or for a long period, absent, or its restoration is incomplete. It is difficult, except on the theory of a separate moral faculty, to account for the case, certainly very rare, of one child in a respectable family exhibiting from infancy marked depravity, lying, cruelty and general perversity, without appreciable defect in intellect, or in some cases with mental powers above the average, even genius in special directions.

Moral idiots are usually the offspring of parents tainted with insanity, epilepsy, intemperance, or some neurosis. The causes are the same as in general idiocy and imbecility.

The symptoms first appear in infancy ; the child is found to be perverse, difficult to control, obstinate, cruel, wanting in natural affection, incapable of telling the truth, or of realising the reason for doing so. These defects become, as a rule, more evident as the child grows older ; sexual depravity is usually a marked and early feature. The essential character of moral idiocy is an absence of the power of appreciating ethical principles and altruistic motives, and the want of that inhibiting or controlling quality known as conscience, which includes the sense of right and of duty.

Complete absence of the moral sense without defect in the other mental faculties is very rare ; such cases do exist, and when combined with intelligence form a class dangerous to the community. Persons of this type are utterly depraved, given over to the indulgence of their egoistic and immoral inclinations, they are incapable of appreciating right and wrong, addicted to vice of every description, and devoid of any feeling of shame for their acts. Their intelligence, being well developed, enables them to see the risk of unrestrained gratification of their desires, and to avoid acts which would bring on them the penalties of the law ; but the controlling power is weak, and the vicious desires, originally strong, become more powerful by indulgence so that usually the moral idiot, after a time, falls into criminal ways. The depraved life which he leads generally produces degeneration of the mental faculties, and not infrequently marked insanity.

The recognition and estimation of moral idiocy is extremely difficult ; the subjects of this defect may be intellectually acute, possessed of good memory and reasoning powers, a careful inquiry is necessary, which should include a complete study of the family and personal history. The moral idiot has no conscience and is incapable of realizing the necessity of controlling his desires, the moral perception is wanting ; in other respects his mind may be normally developed, and in some cases intellectual ability of a high type has been combined with an entire want of the moral faculty. The responsibility of a person of this type is most difficult to decide, he knows the nature of his acts, and that they are contrary to law, but the absence of the moral faculty prevents him from viewing them from the standpoint of normal people. He is an imperfect individual, wanting in the highest quality of the mind ; in estimating his responsibility, this should be taken into consideration.

CHAPTER XXIV.

ACQUIRED MENTAL DISEASES.

UNDER this heading we place all forms of mental derangement occurring in the developed mind and not directly due to defective development, or to degenerative changes.

In an individual born with a healthy brain, the development of mental functions begins very soon after birth, and is due to the action of repeated impulses, transmitted from the senses, on certain elements of the brain which gradually become endowed with special functional activities, the manifestations of which constitute mental phenomena. The development of the mind depends on the inherent quality of the brain elements, on their continued healthy condition, and on the sensory impulses to which they are subjected. It is probable that the inherent quality of the brain elements is the important factor of mental endowment, certainly, we see great differences in the mental faculties of individuals brought up under similar surroundings. The acquired insanities are manifestations of disordered functional activity of those special elements of the brain which form the physical basis of the mind. The causes which produce these derangements are divisible, in a general way, into two classes, those which act on the nutrition of the brain elements, and sensory impulses. As to the relative importance of these two classes of causes, opinions differ; many alienists give the first place to changes in nutrition, using the word in a wide sense as including not merely defects in quantity, but also and of much greater importance, the presence in the blood of toxic substances, capable of disordering the metabolism of the brain cells.

Toxic substances may be of external origin, as for example alcohol, lead, morphine, cocaine, chloral, hemp, and many other drugs, which are known causes of insanity. Of late years, many cases of mental disease, which formerly would have been attributed to sensory impressions, have been considered due to auto-intoxication by substances generated in the body, in consequence of disease, or as products of normal metabolism which have not been eliminated, or of which there has been over production. Auto-intoxication from the digestive tract is considered to be one of the most common causes of insanity. The toxic causation of insanity is supported by the frequency of mental derangement after infectious diseases. The subject is of great interest and practical importance but an adequate discussion of it is beyond the scope of a work on medical jurisprudence.

Mental disease may be due to the absence of substances normally produced within the body, of this Myxœdema is a proved instance. It seems probable that the internal secretion of other glands may be necessary for mental health.

The causation of insanity by sensory impressions, though probably not occurring as frequently as supposed by the older writers, is nevertheless beyond doubt; many cases of mental overthrow date from the receipt of some form of mental shock, fright, bad news, loss of fortune, death of a friend or other means by which strong mental emotion is produced. It is true, that in most cases of this class a predisposition to mental derangement is found, but the same holds with all cases of insanity whatever may be the exciting cause. In fact, insanity rarely attacks those in whom no predisposition exists; all persons are exposed to the exciting causes, but it is only those who are vulnerable that suffer.

Domestic and business worries, prolonged mental strain, especially, if attended with anxiety, are frequently found in the history of cases of insanity. These conditions affect the general health, produce impairment of digestion, disorder the circulation, cause sleeplessness, and a general lowering of the system. Many alienists ascribe the mental derangement in these cases, to toxic substances, generated in the disordered digestive organs, and to the impaired nutrition of the brain-cells.

Love and religious excitement are also held to be causes of insanity; it is probable that any strong emotion may, under certain circumstances, derange the mind.

The frequent occurrence of predisposition, in cases of insanity, has been mentioned, and of predisposing factors the most-important is heredity. Nearly 50 per cent. of insanes have a family history of mental disease, or of mental peculiarities not amounting to actual insanity; it is very probable the percentage would be larger were it possible to trace back the family history, as regards mental health, for three or four generations. Experience proves that the offspring of an insane mother are more likely to become mentally affected than when the insanity is on the father's side ; according to some authors, maternal transmission is twice as frequent. It is not to be supposed that the children of insane parents necessarily become insane, they may escape altogether, or the disease may appear in one or two only, or it may skip one or two generations.

The direct inheritance of acquired insanity, that is its appearance in the offspring, without the action of an exciting cause, toxic or sensory, is improbable ; what is transmitted is a condition of instability of the brain elements, rendering them susceptible to the action of exciting causes, toxic or sensory, which would be powerless to disorder the mind in the absence of inherited susceptibility.

Alcoholism of the parents, especially of the mother, is a predisposing cause of great importance.

Other predisposing factors are, civilization, sex, age, civil condition, and profession. Next to inherited susceptibility, the conditions of civilized existence are more largely responsible for mental break down than any other predisposing factors. The stress and excitement of town life, particularly on persons accustomed to quiet surroundings, tend to produce a susceptibility to mental disorder.

Age is a predisposing factor ; insanity, excluding idiocy, is rare in childhood, becomes more common at puberty, is most common in early manhood. In women, there is a special predisposition at the time of the menopause. In old age, there is greater tendency to degenerative changes in the brain, but less to acquired forms of insanity. Experience shows that there is less insanity among the married than the unmarried, probably because the former lead a more natural and healthier life.

In concluding this brief account of the etiology of acquired insanity, it may be pointed out that in most cases, several causes are engaged, some of which may be obvious, others discoverable only by careful inquiry into the history, personal and family. Moreover, it is well to recollect that the statements of persons unacquainted with the course and symptoms of mental disease, are often inexact, and they very frequently confuse cause and effect, attributing the disease to what is, in reality, one of its manifestations.

MANIA.

This term is applied to all forms of acquired insanity, characterised by excitement and loss of self-control. Following the usual classification we distinguish, ACUTE DELIRIOUS MANIA, ACUTE MANIA, and MANIA. This classification is not followed by some of the later writers on insanity. They place mania among the degenerations, and the acute delirious form in a special division under the name, primary confusional insanity.

ACUTE DELIRIOUS MANIA OR MANIACAL DELIRIUM is a form of mental disorder, quite distinct from the acute mania. It is characterised by sudden onset, often definite causation, rapid course, terminating within a few days or weeks, ending in sudden and complete recovery, or in death, a fatal result is common.

The disease generally attacks young adults who have been exposed to severe mental or physical strain for some time. It may suddenly follow a shock, physical or mental, or arise during an attack of fever, pneumonia or other exhausting disease, or after a surgical operation.

The patient suddenly falls into a condition of intense excitement, he is delirious, incoherent, loses all appreciation of his surroundings. He rapidly becomes extremely noisy, violent, tears his clothes, destroys furniture. He has no idea of decency, is sleepless, refuses food.

With these mental symptoms, there are marked physical signs, the temperature is raised often to 103° or 104° Fah., the face is flushed, the tongue furred, the breath foul, the bowels constipated. The body wastes rapidly, and death from exhaustion may occur within a few days.

The symptoms vary in different cases ; in some the patient is in a state of frenzy lasting a few hours or days, ending in deep sleep from which he awakens completely restored and with no recollection of his illness. In others, the delirium is less marked, lasts longer and subsides slowly. When recovery takes place, it is, as a rule, complete and recurrence is rare.

ACUTE MANIA.

In this disease the onset is gradual and the exciting cause is seldom apparent. For some days the patient is out of sorts, sleeps badly, is dyspeptic and constipated. His mental condition is one of depression and melancholy. After a time, a change occurs in his demeanour, the depression passes off and gives place to exaltation and excitement, he is unusually bright and jovial ; very often his friends, who had been alarmed during the period of depression, look on his good spirits as a sign of renewed health, but they soon find he is over excitable, that his talk tends to incoherency, and that his manner is uncertain, irritable, and indicative of self importance and exaltation. The symptoms increase, there is great excitement, a rapid flow of disconnected ideas, sudden emotional changes ; the patient may be maudlin at one moment and laughing gaily the next. The imagination is deranged, every sensory impression starts a new train of ideas ; the mind is filled with a jumble of disconnected thoughts, the power of concentration and steady thinking is lost. There is a constant flow of words which display the chaotic state of the mind. There is great exaltation and self-importance, the patient is perfectly satisfied with himself ; his delusions are of a self-exalted character. He considers himself to be a man of great strength, or of great wealth, a poet, a general, a king or a person of great importance. The delusions, though partaking of the character of self-importance, have not the fixity of delusional insanity, and are often fleeting, started by every new impression ; as when he sees an acquaintance and mistakes him for some one else, or a familiar object is transformed into something terrifying or into something ludicrous, producing for the time a corresponding change in manner and actions.

The patient sings, shouts, dances, is in a state of incessant action, destroys his clothing and articles of furniture. The incessant motor excitement is kept up for days, without producing signs of exhaustion, he appears to be endowed with extraordinary strength and performs feats that seem impossible. Sleep is irregular, often none for days. The appetite is capricious, may be lost or exaggerated. The digestion is impaired, the breath foul, the bowels deranged. Sensibility is usually altered, the patient appears to be insensitive to pain, to heat and cold ; bruises and other injuries are unnoticed. Perverted feelings are not uncommon, itching, formication may be complained of. Hyperæsthesia of sight and hearing is often present. The bodily temperature is seldom much increased, and may be normal or subnormal even during great excitement. Perspiration is often profuse and offensive ; the urine scanty and high coloured. In women the menses are generally absent ; in both sexes there is a tendency to sexual excitement, leading to acts of indecency ; masturbation is common.

The duration of the attack varies from a few days to several months, average duration under six months. Recovery takes place slowly, the mental excitement gradually subsides ; occasionally, the cure is more rapid. As a rule recovery from first attacks of acute mania is perfect, no sign of mental disease being left ; but after repeated attacks, the restoration is incomplete and the case finally passes into a state of dementia. The prognosis as to freedom from subsequent attacks is bad, recurrence is almost certain. In the process of recovery, the highest functions of the mind are the last to be restored, and alteration in the moral sense may persist long after all signs of intellectual disorder have passed away.

MANIA.

The manifestations of mania present the same general characters as those of the acute form, but the mental disorder is less tumultuous, the excitement and exaltation do not reach the same extreme height. The difference between acute mania and mania is one of degree only, in general features, duration and termination they are similar.

In the mildest forms, which for the medical jurist possess great importance, the symptoms indicate an overactivity of the mental faculties. The patient appears to be abnormally bright, clever and quick witted. He is more talkative and active than before ; very energetic, plans great schemes and exhibits an exaggerated self importance. But in the carrying out of his plans, a want of judgment and reliability is exhibited, and in his general conduct he displays a foolishness, which is in marked contrast to the cleverness of his conversation. The higher controlling powers of the mind are more involved than the intellect, and in addition to unreliability there is very often a want of the moral sense, cases of the above type may recover without the diseased mental state having been recognised, the attack is often transitory and it may be attributed to drink.

In the more pronounced types of the disorder, the derangement of the mental functions is exhibited in noisy irrational conduct, great excitability, delusions, moral perversions, and general features approaching those of the acute variety. In some cases the symptoms of moral perversion are predominant; a previously religious man becomes debauched, degraded in his habits, and a denouncer of religion. In other cases the intellectual faculties are chiefly affected.

MELANCHOLIA.

Melancholia is a disease of the mind characterized by more or less marked depression and, in the pronounced forms of the disorder, by delusions, and by suicidal tendencies, often very strong.

In the slighter forms of melancholia, the patient is depressed, his health is run down, he sleeps badly, and is troubled by vague feelings of some calamity impending, or of being unfit for his position and unworthy of trust. He is aware of the unreasonableness of these feelings and tries to shake them off.

If the disease increases the depression becomes more marked, the patient worries over his work or family affairs, his health suffers, he complains of insomnia. Gradually he becomes possessed by the idea that he has committed a crime, or that he is ruined, or that he has broken the moral laws, or that he is suffering from some strange or incurable malady. In the earlier stage of melancholia, the depression is intermittent, and in the intervals, the patient goes about his work and behaves rationally. But when the disease is well established, the depression is constant, the judgment and mental powers are affected, his whole mind is concentrated on his mental distress, which is exhibited in his appearance. In some cases the patient remains in one position for hours, without moving or speaking, wrapped up in his gloomy thoughts; others go about in a condition of frenzy, tearing the hair, wringing the hands, crying and talking of their misery and of the crime which caused it. At this stage, there is often a strong tendency to suicide, to escape from the misery; or the patient may become possessed of the idea that by torturing himself or by taking his own life, he can expiate his crime. In some cases he hears voices or sees figures urging him to suicide.

In melancholia a tendency to suicide is very common and should be guarded against in all cases, even the mildest.

Homicide is also a danger in melancholia, the patient may believe that by killing he is saving people from falling into his own condition of misery, or he may act on the delusion that he is ordered to kill, or he may murder in order to be hanged.

The bodily health is affected; the stomach is disordered, the tongue furred, breath foul, bowels constipated. Insomnia is generally present, and when sleep takes place, it is disturbed by distressing dreams. The skin is harsh and dry; the urine high coloured, and loaded with urates.

There is always a distaste for food, often complete refusal, which may be due to the physical uneasiness the food produces in the disordered stomach, or to a feeling of unworthiness and a desire to die of starvation.

The general derangement and lowering of the health produce abnormal sensations in the body, which often form the basis of delusions in the later stages of the disease. A patient who experiences an uncomfortable sensation in the abdomen, subsequently believes that he is the subject of cancer or that an animal is knawing his vitals.

Melancholia, as a rule, begins insidiously and the symptoms increase gradually. Cases of sudden onset, from mental shock, are not common. The earlier stages of the disease often pass unrecognised, the period of full development usually extends to months, and convalescence takes place slowly and may be interrupted by temporary exacerbations of the symptoms. The beginning of recovery is generally indicated by an improvement in the physical health, appetite returns, the digestion is better; the patient becomes less depressed, begins to take an interest in his surroundings, and gradually the mind is restored to its normal state. In some cases, an injury or an inflammatory affection may start the process of recovery. Occasionally, the disease subsides suddenly after sleep or under other circumstances.

The prognosis is favourable, recovery may be expected in a large proportion of cases even of the well-marked type. Sometimes the disease passes into a chronic condition, and after years may end in recovery or in dementia. In the chronic variety the symptoms are generally of a type resembling paranoia, with delusions of a depressed character ; in some cases the patient denies everything, his own existence, and the reality of things around him. Recovery is not hopeless even in cases of the chronic variety.

Circular Insanity.

Attacks of melancholia and mania may alternate, with or without an intervening period of normal mental condition. In some cases the disease begins with depression, which after a time passes into maniacal excitement, in others the order is reversed, mania precedes the melancholia. In many cases lucid intervals occur, frequently short, occasionally long, extending to months or even years. A lucid interval may take place between the two phases of the disease, but more often one passes into the other gradually or suddenly without any period of mental health between them.

In some cases, the symptoms of mania are more marked and the mental disturbance is greater than during the melancholic period. In other cases, there may be slight excitement followed by marked depression. In the early manifestations of the disease, the symptoms are slight ; the patient has alternating spells of excitement and depression, which gradually become more marked, and after a time, the diseased state of the mind is recognised. The diagnosis in the first instance is generally mania or melancholia according to the predominant phase, but when one or more cycles have been observed the true nature of the disease is apparent.

The prognosis as to cure is bad, recurrence is almost certain, succeeding attacks tend to follow with shorter intervals, and commonly the patient sinks into a condition of dementia.

Paranoia.

Paranoia also known as delusional insanity or partial insanity, is a chronic mental disorder, characterized by the existence of a fixed delusion, the patient being rational on all other subjects.

A typical case of paranoia passes through three stages, the first a period of hypochondriacal depression ; the second, a stage of fixed delusions, generally, of a persecutory character ; and, finally, a condition of megalomania and mental failure. The disease does not always exhibit these stages, the first is often unrecognised; not infrequently, the patient remains for years or to the end of life in the second stage without passing into the condition of megalomania.

The onset of paranoia is not definite; the patient experiences vague feelings of mental disquietude, he worries over bodily sensations and begins gradually to find a morbid significance in the actions and sayings of others. This stage may be short, or last a long time. It is seldom recognised, the patient goes about his business and converses rationally, no change may be noticed in him, or some slight oddity of manner. As a rule, he does not speak of his mental worry, he is aware that others will not agree with his opinion of its causation, and at this stage it is probable that he does not himself completely accept the reality of the annoyances which worry him. After a time, the second stage of the disease is entered on, the patient now completely accepts the reality of the annoyances he is troubled with. He believes he is an object of persecution; at first, the feeling is vague and he is unable to describe what he suffers or the cause of it. After a time he begins to speak of the annoyance, the reticence of the first stage is lost. The delusions are often of a very extraordinary character, they have one common feature, they are disagreeable to the patient; in some cases, the delusion takes the form of persecution by a society of persons banded together to draw away the patient's vital fluid; in others the patient believes that he is being mesmerized, or galvanized, or acted on by some mysterious force. Some complain that people are listening to their thoughts by means of telegraph wires or telephones. Some are constantly annoyed by a bad smell or taste, which they believe is the work of people who wish to annoy them. In some of the cases, the annoyance complained of is of a petty trivial nature, but none the less worrying to the patient; one man constantly heard a voice calling him by name, another heard his thoughts repeated by a voice a little way off.

In the earlier period of this stage, the patients do not connect the annoyance with particular individuals, but, after a time, as the result of long continued dwelling on the delusions and efforts to account for them, they believe that certain individuals are causing the annoyance. They hate their persecutors and may commit an assault on them. When the delusion has become fixed and the source of it identified, the patient is often reticent and while willing to speak of his sufferings, conceals that he believes they are caused by certain persons. In many cases, it is extremely difficult to discover the delusion; repeated examination may be required before it is found out. The striking feature of paranoia is, that, with a fixed delusion, often of a very mad type, the individual is in all other matters reasonable, intelligent and capable of carrying on his business. Paranoics have conducted extensive business transactions, kept accounts, held public offices with success, though all the time they suffered from a fixed delusion of persecution. These individuals are, nevertheless, dangerous; they have self control, but it may be lost at any moment, and they may commit a sudden assault on those they consider their enemies.

The stage of delusions of persecution may last for years, the disease may never extend beyond it, but in most cases, after a time, delusions of grandeur and self-importance gradually take possession of the patient. In many cases, the delusions of megalomania arise out of those of persecution, he patient, trying to account for his being persecuted, comes to believe that it is owing to his being a person of importance or of special qualities. Megalomania may exist with delusions of persecution, or the latter may disappear or fall into the background, the patient being filled with ideas of his grandeur and self-importance.

When megalomania is established, the patient's manner and demeanour accord with his delusion, if he believes himself to be a king he comports himself accordingly and proclaims his regal station. Whatever may be his delusion, he endeavours to act in accordance with it, and no reasoning or demonstration has any effect on his belief.

It is a very curious feature of the disease that the patients are apparently incapable of seeing the inconsistency between their occupations and surroundings and their delusions. A man who believes himself to be a king, will do menial work; one who believed he was endowed with a peculiar mystic force, carried on his previous occupation. A man who had the delusion that two and two made four and a quarter, kept the books of the asylum correctly on what he called the "old system."

In these cases, the patient in all matters not connected with his delusion is perfectly reasonable and could pass for sane to any casual observer. This stage of the disease may last for years without change, but generally evidence of mental weakness and loss of reasoning power is found after a time. These signs tend gradually to increase, the patient becomes excessively egotistical, defective in moral sense, displays a tendency to wandering of the thoughts and to an absurd extravagance in language when talking of his delusions. There is also very often a tendency to from new words to express thoughts connected with the delusions.

When the third stage of the disease is well established, the patient is less dangerous than in the second period, but he is not to be regarded as harmless. He may still retain the delusions of persecution, and under their influence attempt to obtain revenge on his enemies.

The exaggerated estimate of his importance and the weakness of his judgment and reason in all matters in any way connected with his delusions cause the patient to be extremely suspicious of insult, intolerant of opposition, and ready to resent any fancied slight. In some cases, which constitute a well marked variety, there is a tendency to constant quarrelling and litigation. They are continually starting legal proceedings, either in a criminal court to get satisfaction for some personal insult or injury, or in the civil courts, against persons who, they believe, have defrauded them, or are instrumental in keeping them out of property. They go from one court to another, never accept the legal decisions against them and, after having exhausted the machinery of the law, take to writing to the papers or to high officials with the object of getting their grievances inquired into. Sometimes, with the object of directing attention to themselves, they assault or insult some prominent person.

The duration of paranoia is prolonged, the disease progresses slowly, and may remain permanently in one stage. Cases are more common among women than men, and usually the onset occurs after the age of thirty. In nearly all cases heredity is prominent, the exciting causes are seldom definite.

The prognosis as to cure is bad, recovery seldom occurs, but if the patient is removed to an asylum and carefully treated the symptoms may be favourably modified.

EPILEPTIC INSANITY.

Epilepsy is a disease of the nervous system, characterized by attacks of loss or impairment of consciousness, with or without convulsions. The seat of the disease is in the cerebral cortex and the attack or fit appears to be due to a sudden excessive discharge from the cortical cells.

The fit may be momentary, manifested only by loss of consciousness, this is called the minor or petit mal; or the unconsciousness may be of longer duration, accompained by tonic and clonic convulsions, the major or grand mal. These two forms are often combined in the same individual. The epileptic fit may take another and forensically more important form, it may be preceded, or followed, or replaced, by a sudden and often very brief attack of insanity, which has a special tendency to assume a furious and impulsive character.

In dealing with epileptic insanity, it is necessary to distinguish between the condition of mental weakness and degeneration to which cases of long continued epilepsy of the ordinary form, grand mal and petit mal, are liable, and the rare cases, in which an attack of acute insanity is combined with, or replaces the fit, psychic or larvated epilepsy or epileptic equivalent.

In cases of epilepsy of the ordinary type, grand mal or petit mal, the mental condition of the patient during the interval may show no sign of alteration, even throughout life, but, as a rule, especially if the attacks occur frequently, after some years, deterioration of the mind is observed, and probably one-half of the epileptics, if they survive long enough, pass into a condition of more or less marked dementia.

The earliest signs of mental deterioration in epileptics are usually exhibited in the conduct and self-control, increased irritability and restlessness; the patient is easily angered and when angry often ungovernably furious, though, at other times, quiet, peaceful and inoffensive. Most epileptics exhibit a marked tendency to sexual and alcoholic excesses; very often they display, in regard to alcohol, an extreme susceptibility, a small quantity causes intoxication of an unusually violent and quarrelsome character. Hypochondriasis is often present, also self-importance. Some epileptics are morose, sullen, and reticent ; others are jovial, talkative, and voluble regarding their ailments. In nearly all cases, there is a marked emotionalism, often of a religious type.

Individuals presenting the signs of defective self-control above mentioned, may continue unchanged for years or throughout life, but in many cases, especially in those in which the fits occur at short intervals, after some years evidence of involvment of the mental faculties is found, memory, judgment, will power, are weakened, and in some there is a gradual progress to dementia which may, if the patient survives long enough, become profound.

The more important and characteristic form of epileptic insanity is that in which an attack of acute mental disorder precedes, follows, or replaces the epileptic fit.

In nearly all cases of epilepsy of the severer type, the patient before the fit experiences some mental disturbance, generally vague feelings of depression, confusion of thought, restlesssness, and irritability.

In certain rare cases, the fit is preceded by pronounced mental disorder, amounting to insanity. The symptoms vary ; some experience hallucinations, generally of a terrifying horrible character, occasionally taking the form of gorgeous visions and enteancing sounds. The mental disorder may be of the nature of an impulsive insanity, the patient is possessed of the desire to kill some one or to burn or destroy something, he is aware of the criminality of the desire and does all he can to prevent himself yielding to it, but it may overpower his self-control. In some cases the fit is preceded by an outbreak of acute maniacal excitement, with marked tendency to destructiveness and violence. The duration of an attack of PRE-EPILEPTIC INSANITY varies from a few minutes to several hours and, in rare cases, days. After the fit, the patient is generally very exhausted ; he may have a distinct recollection of the beginning of the mental disorder and of his actions up to the moment of the epileptic fit, more often, the memory is confused and in some cases he remembers nothing of the occurrence.

POST-EPILEPTIC insanity is more common than either the pre-epileptic or the larvated forms.

In every case of epilepsy, the fit is followed by a short period of mental confusion and stupor, which disappear quickly. In post-epileptic insanity, after the fit, the patient passes into a condition of acute mental disorder, which may last a few minutes or one or two days, rarely longer. The most frequent form of post-epileptic insanity is mania, usually of a furious type, marked with violence of a particularly brutal character. The patient seems to be actuated by some terrifying delusion which produces a condition of fear, combined with frenzy, and drives him to commit the most brutal attacks on others. The insanity passes off suddenly, the patient has no recollection of the occurrence, his mind is a blank from the onset of the epileptic fit to the disappearance of the mental symptoms. He finds himself exhausted, often in a strange place, or in jail charged with acts of which he has no recollection. The mental disorder of post-epileptic insanity may take the form of extreme depression, or of a stuporous confused state, or of a paranoic character, lasting from a few hours to several days.

LARVATED OR PSYCHIC EPILEPSY OR EPILEPTIC EQUIVALENT is a sudden brief attack of insanity, generally of a maniacal type, occurring in place of an epileptic fit, or accompanied by symptoms of anomalous character which represent the fit. In one case, a young man, three or four times a year, experienced a peculiar sensation in the epigastric region, followed immediately by a period of one or two days of blankness, from which he awoke to find himself far from home, his clothes dirty, torn, his appearance disreputable, his pockets filled with numerous articles of a miscellaneous character, some valuable, others worthless. He had not the least idea of how he acquired them, or what he had done from the moment he felt the peculiar epigastric sensation.

The symptoms of larvated epilepsy are strange and unaccountable conduct, a tendency to violence, often of a brutal type, impulsiveness ; the patient may be seized by a desire to walk straight on, or to perform some peculiar action. The most typical cases are those in which acute maniacal furor comes on suddenly, has a short duration, and the patient has no memory of the acts performed during the attack.

It is important to note that the acts of violence may appear purposive, directed against a person, towards whom the epileptic is known to have vindictive feelings; this adds greatly to the difficulty of proving the patient's irresponsibility, but there is ample evidence in the records of asylums to show that purposive acts are not infrequent among epileptic insanes, regarding whose irresponsibility there can be no doubt.

CHAPTER XXV.

GENERAL PARALYSIS OF THE INSANE.

General paralysis of the insane, or paretic dementia, is a disease of the brain, also occasionally of the spinal cord, characterized on its psychic side by a slowly progressing dementia, attended with fleeting delusions and emotional disturbances; and on its physical side, by a gradually increasing paralysis and incoordination of the motor system.

It is a disease of middle life, most of the cases occurring between thirty-five and forty-five. It is seen much more often in men than in women, and mostly occurs among persons engaged in occupations involving mental and physical strain. The disease is rare in rural districts; it appears to be increasing among the inhabitants of large cities.

The causation of general paralysis is not settled; the opinion at present prevailing and for which evidence appears to be very strong, is that it is connected with syphilis. Statistics show that in cases of general paralysis, a history of syphilis, inherited or acquired, is present in from 80 to 90 per cent. It is not considered to be a manifestation of syphilis, but that the syphilitic poison, acting on the nutrition, induces changes in the normal metabolism, in consequence of which, toxins are manufactured, and that the disease is due to their action. As a rule, the history shows that the syphilitic infection occurred many years before the development of general paralysis. Other causes have been assigned, lead poisoning and alcoholism. The immediate exciting causes are mental strain, excesses, sunstroke, traumatism.

The disease has been divided into stages for convenience of description, but the demarcation is artificial and not always recognisable.

Prodromal Stage.—The onset of the disease is generally indefinite; the patient feels greater difficulty and more exhaustion in doing his work, notices that he makes more mistakes and is more forgetful and has greater difficulty in keeping his attention fixed on what he is doing than formerly. He worries over these defects which gradually become more marked; his temper is irritable, he is easily angered, especially by his family, to strangers he may be affable and pleasant. Gradually he becomes restless, boastful, neglectful of his work, displaying a fitful energy, plans great schemes which constantly change and are not carried out, or he plunges into wild speculation. In speaking, a difficulty in articulation is apparent in some words, and in writing there is a tendency to omit letters, syllables or whole words. The chief change is in the moral sense ; manifested by lewd conversation, offences against decency in public places, and attempts to outrage women or children.

In addition to difficulty of articulation of certain words, there is, generally, tremulousness of the lips and tongue, and an alteration in the appearance of the face. The features show a want of expression, due to slight paresis of the facial muscles. Later on this condition is very marked. Changes in the pupils are common, generally, contraction and inequality, with loss of accommodation to light. Headache is a very common symptom ; pains of a girdle character may be experienced. The digestion is apt to be deranged.

The symptoms, mental and physical, increase gradually, and the disease passes into the STAGE OF FULL DEVELOPMENT, characterized by mental exaltation, maniacal excitement, delusions of grandeur; and on the physical sides, by difficulty in articulation, tremulousness of the muscles, not only of the tongue and face but throughout the body, marked deterioration of the handwriting, and inability to perform any work requiring the co-ordinated action of several muscles.

The mental condition exhibits great variety; in some patients, there is an acute mania, in others, melancholic depression is more evident. There are delusions, which, generally, take the form of extravagant ideas of self-importance, great-wealth, great-personal achievements, extraordinary strength, great sexual capacity. The delusions are not of a fixed type, they change continually. The patient may exhibit a tendency to kleptomania, stealing useless articles as well as valuables. Some patients suffer from delusions of a persecutory and terrifying character, they may believe that they are going to be tortured, injured in some way, or that their entrails are being destroyed by vermin. Occasionally, in the course of the disease, sudden outbreaks of violence occur, usually, of short duration.

The physical signs gradually become more marked. The gait is ataxic, speech is more embarrassed and accompanied by spasmodic twitchings of the face ; the patient finds difficulty in doing simple things, such as buttoning his clothes. After a time, walking is no longer possible ; deglutition is difficult, and there is danger of the patient choking, owing to involvement of the pharyngeal muscles.

The patient becomes neglectful of his person, dirty in his habits ; control of the sphincters is uncertain.

Epileptic seizures are of frequent occurrence, and after an attack, the mental and physical signs of the disease are greatly increased.

The transition to the STAGE OF DEMENTIA occurs slowly. From an early period of the disease mental weakness is present, though easily overlooked, owing to the symptoms of maniacal exaltation. There is a gradual development of the signs of mental degeneration, the faculties become slowly obliterated, and the patient passes into a condition of complete dementia. On the physical side, the symptoms of degeneration are equally evident, the body wastes rapidly, all control of the sphincters is lost, cutaneous sensibility is greatly diminished, trophic changes occur in the tissues, the nails become brittle, the bones frangible, the cartilages lose their resiliency. Bed sores form in spite of the greatest care ; the patient is reduced to the condition of an automaton, he can do nothing for himself, cannot walk, move in bed, swallowing which lasts longest, is difficult and dangerous. Death finally occurs from exhaustion, or the patient is carried off by an intercurrent attack of disease.

The average duration of general paralysis is about three years. Some cases end rapidly, others are prolonged for years. The prognosis is bad, the disease is always fatal ; remissions may occur, during which the mental symptoms are greatly improved and the physical signs arrested. If the remission occurs in the early period of the disease, the patient may appear to recover completely, but some mental defect always remains, and after a variable time which may extend to months or years, the disease again progresses. More than one remission may occur, and the disease may last for many years.

ALCOHOLIC INSANITY.

The effects of alcohol on the brain and central nervous system are well known. The intoxication which results from alcohol is a condition of mental derangement of a temporary character but it is not generally considered to rank with insanity, though some alienists would so classify it.

Occasionally there is observed in nervous excitable persons a condition of acute maniacal delirium due to alcohol and known as DELIRIUM EBRIOSUM or mania à potu. The symptoms are noisy delirium, a tendency to commit acts of violence; the patient is aggressive, has delusions, hears people abusing him or plotting to kill him. He may exhibit impulses which may take different forms, suicide, homicide, theft, or destruction of property. The symptoms usually subside in a day or two. This form of alcoholic insanity is said to occur, generally, in persons who only very rarely take alcohol to excess, and in most cases it will be found, on inquiry, that the patient has always exhibited an unusual susceptibility to alcohol, in some cases a history of head injury or of sunstroke is present.

DELIRIUM TREMENS OR ACUTE ALCOHOLISM is a condition that follows protracted and excessive indulgence in liquor; it results from the long continued action of alcohol on the brain. It very seldom occurs in a temperate person who goes in for a bout of drinking; most of the cases are chronic drinkers, in whom the disease follows a temporary excessive indulgence, or results from some sudden shock, mental or physical, fright, an injury, or an acute inflammation.

The disease begins with depression, sleep is broken by terrifying dreams, there is great restlessness, the patient is tremulous, cannot eat, has a loathing for food. In a day or two delirium sets in, he talks incessantly, is very restless, and noisy; the delirium is ushered in by hallucinations and illusions of a terrifying character, the patient sees snakes or rats or hideous animals crawling towards him; these hallucinations cause extreme terror. In some cases, hallucinations of hearing and of the other senses are present, the patient hears voices abusing him or commanding him to perform certain acts. The delirium is of a noisy character, yet, as a rule, the patient can be quieted temporarily by a sharp command from a stranger. The terror caused by the hallucinations may lead to dangerous acts. The patient should be closely watched to prevent him from jumping out of a window or rushing out of the room, to escape from the creatures of his imagination. In some cases, a suicidal tendency is present, also not infrequently, the patient is dangerous and attempts to murder those about him, under the influence of delusions of persecution or in response to imaginary mandates.

The physical signs are tremor and agitation of the muscles, most marked in the face, lips, tongue and hands. Digestion is completely disordered, the tongue is thickly furred, the breath foul ; the temperature is slightly raised but in bad cases there may be high fever ; the pulse is soft, rapid and compressible. Insomnia is a constant feature.

In favourable cases on the third or fourth day, the restlessness subsides, the delirium disappears and the patient sleeps. The prognosis is favourable, but the disease is dangerous, especially to individuals with diseased kidneys. The patient may be troubled with insomnia, distressing dreams and nervousness for a considerable time after the attack.

Chronic Alcoholic Insanity.—The long continued excessive consumption of alcohol tends to produce mental deterioration, characterized by marked lowering of the moral sense, enfeeblement of the will and judgment, combined with morbid emotionalism. The individual becomes unreliable, untruthful, deceptive ; he is apathetic, neglectful of his affairs, loses all initiative, is easily influenced and led by others. He is a slave to his craving for alcohol and cannot overcome it. Attacks of acute mania or melancholia often occur in chronic alcoholics with insane heredity, but the most characteristic and common form of alcoholic insanity is of the type of delusional insanity with delusions referring to the sexual organs, the sexual relations and to poisoning. The patient complains of attempts being made to mutilate him sexually or to destroy his virility by poison. He is suspicious, trivial circumstances are brooded over, gradually delusions of the unfaithfulness of his wife take possession of his mind ; in other respects, he may be quite rational. The presence of delusions of the type referred to may result in outbursts of homicidal violence.

The physical condition of a chronic alcoholic is characterized by tremor, most marked when the patient is sober, chronic gastric catarrh, disordered bowels ; symptoms of deranged cutaneous sensibility are often complained of.

When chronic alcoholic insanes are placed in an asylum, the symptoms may improve, the delusions may completely disappear and the patient appear to be quite sane, but, not infrequently, an impulse of a suicidal or of a homicidal character persists, and, if the opportunity occurs, is carried into effect. These cases are extremely difficult to diagnose, the patients are quite rational and the impulse is carefully concealed.

Most cases of chronic alcoholic insanity, if they live long enough, sink into dementia ; in some the condition resembles general paralysis of the insane.

MORPHINE INSANITY.

The statements in the text books show that insanity caused by opium or morphine, is comparatively often met with in Europe and America. In India, though opium-eating is very common, cases of insanity, which can be traced to its use, are exceedingly rare.

The ordinary form of mental disorder produced by opium or morphine is a weakening of the will, lowering of the moral sense, and deterioration of the mental faculties generally. The individual becomes unreliable, indolent, untruthful, incapable of steady effort and addicted to sexual excesses.

In the more marked cases actual insanity is produced, resembling that resulting from alcohol, but less boisterous, more depressed in character. Delusions of persecution or of grandeur may be present ; the patient may be greatly troubled by terrifying hallucinations. Morbid impulses, suicidal or homicidal, may exist. There is weakness of the mental faculties and the case generally terminates in dementia.

The physical signs of morphine insanity are loss of appetite and digestive power, insomnia, irritability, weakness and finally complete loss of sexual power, tremors and muscular weakness of the limbs, marked emaciation.

Imperative Ideas, Impulsive Insanity, and Allied Mental States.

The derangements of the mind, which it is proposed to describe under the above heading, exhibit a wide range of symptoms of extremely varying gravity. All have the common basis of being due to the presence, in the mind, of ideas which persist in spite of the resistance of the will, and which, in some types, impel the individual to act against his will, judgment and moral sense.

Everyone has experience of the sudden invasion of the consciousness by an idea or group of ideas which interrupt the course of thought, and may completely replace it, in spite of the efforts of the person to banish them. Many people have undergone the experience of being haunted, for a time, by a catch-phrase, a popular song, a number, a curious thought, or a figure, or something else, and the impossibility of keeping it out of the mind; it does not affect the intellect or the judgment, nor does it prevent work, though it interferes with thought by continually cropping up in the mind and distracting attention, and it annoys the patient. With ordinary healthy people ideas of this kind are transient and disappear without causing any effect, but in persons of a degenerate mental organization, an idea may take possession of the mind, and impel to actions which the individual knows are wrong and towards which he has the strongest aversion but which he cannot resist doing.

Ideas that become fixed in the mind and persist in spite of the will are called OBSESSIONS, FIXED OR IMPERATIVE IDEAS. Any idea of which the human mind is capable may become an obsession, consequently obsessions are as numerous as human thoughts. They may be purely intellectual, without impulse to action; the individual has constantly in his mind a word, rhyme, number, figure or some idea regarding the nature of the deity, or an idea on some abstract subject, which he cannot get rid of. It persists, occupies all his attention, prevents him sleeping, and may completely destroy his health by the constant worry it causes.

The more important class of obsessions is that in which the idea is accompanied by an impulse.

Impulsive Obsessions—have been divided into (1) Obsessions of indecision, (2) Obsessions of fear, (3) Irresistible propensities or Morbid impulses. The last is, medico-legally, the most important, the other two will be referred to very briefly.

OBSESSIONS OF INDECISION.—This is a condition in which the individual is assailed by doubts regarding everything he does. If he posts a letter, he is distressed by the idea that he addressed it incorrectly. If he leaves the house, he returns again and again with the fear that he has left something undone that ought to have been done. In some cases, there is a persistent idea that some important duty has been imperfectly performed ; in others, doubts regarding conduct arise, and the individual distresses himself over imaginary breaches of etiquette and spends hours in reviewing his conduct and recalling every incident.

OBSESSIONS OF FEAR OF PHOBIAS.—In these, the patient suffers from an uncontrollable fear, usually confined to one object or class of object. There may be a fear of syphilis or of hydrophobia or some other disease. Some individuals dread an open space, others an inclosed space. The obsessions of fear are as numerous as ideas of fear. They all depend on ideas which would have only a transient effect on a healthy mind but become fixed and predominant in a degenerate organization.

MORBID IMPULSES OR IRRESISTIBLE PROPENSITIES are of much greater medico-legal importance than the preceding types of obsessions.

Most people have experienced an impulse to do something of which the judgment disapproved, and the will prevented being done. In degenerate minds, a fixed idea may become so powerful as to compel the individual to do an act of which he disapproves, and the doing of which is resisted by his will.

Obsessions or fixed ideas are as numerous as human thoughts, consequently impulses are equally numerous ; they may be of an unimportant type, such as the impulse to do some harmless odd action, or they may be of the most dangerous kind, impelling the subjects to serious crimes, murder, suicide, theft, drink, the destruction of property by fire or in other ways.

The idea of the act may be constantly present for a long time, or it may suddenly appear without apparent cause. Frequently, the idea is suggested by something seen or heard, as for example, the sight of a knife has resulted in an attempt to murder, reading an account of a suicide has resulted in suicide by the same means. The presence in the mind of a desire to commit a criminal act produces in the individual great distress. He knows that the desire is urging him to do what is wrong and abhorrent to his moral sense, he endeavours to resist it but feels that it will overcome his will which it generally does and the act is committed. The performance of the act results in an intense feeling of relief and satisfaction which quickly gives place to grief and remorse for having committed a crime.

The most important impulses are those of suicide, homicide, theft, drink, destruction of property.

Suicidal impulse.—The idea of suicide may be present in the mind of an individual of degenerate organization for a long time without resulting in action. The idea may pass off, and recur after a long interval. In some cases, it arises suddenly and leads to immediate action. In other cases, the resistance of the will is not overcome for days, and the patient may voluntarily place himself under restraint as he feels his will is yielding. An impulse to suicide may arise from the newspaper report of the suicide of some-well known individual, or from the sight of a weapon or some other means of suicide. The recurrence of a suicidal impulse has been traced to the receipt of a box containing the bottle of poison with which suicide had been attempted many years previously; in the interval, the person could have purchased the poison, but did not, nor did he attempt suicide in other ways.

Suicidal impulses are met with in ordinary forms of insanity, but the true impulsive obsession occurs in persons who show no sign of insanity and are perfectly sane in intellect and judgment. The question has often been debated,—"Are suicides always insane?" The findings of Coroner's inquests in England, show that juries hold this opinion. In India, the question does not arise, the law inquires only into the manner of the death, not into the state of the mind of the deceased, except in so far as it indicates that the act was self-inflicted. An experience of a great many cases has convinced me that sane people do commit suicide.

HOMICIDAL IMPULSES.—An impulse to homicide may arise suddenly in a degenerate mind and lead to immediate action, or it may be present for a long time before the will is overcome. The impulse is frequently directed towards a particular person, often, a wife, husband, children or others, towards whom the subject of the impulse bears the strongest affection. It may be a sudden desire to kill and the first person encountered is the victim. The commission of the act restores control and the patient is overwhelmed by grief and remorse ; he makes no attempt at concealment, he confesses his crime and explains the impulse which led to it. In cases of this kind, considerable difficulty is experienced in convincing a jury of the irresponsibility of the doer. The circumstances of the act, the absence of motive, the demeanour of the accused, his account of the occurrence, should be inquired into carefully. His personal and family history, the presence of signs of a degenerate mental organization and of bodily weakness, are of the greatest assistance.

Individuals in whom morbid impulses occur, invariably belong to the class of degenerates or neurasthenics. They exhibit a want of will power, indecision, susceptibility to suggestion, and a want of self-confidence. In body, they are weak, deficient in muscular power, troubled by headaches and other painful sensations ; digestion is bad, the heart is easily excited, the circulation is feeble. Genital disturbances are common, stigmata of degeneration are present, often to a marked degree.

KLEPTOMANIA OR IMPULSE TO STEAL.—The occurrence of a true impulsive obsession to steal is beyond doubt, though, not unnaturally, Magistrates are chary of admitting the plea when put forward in cases that come before them. The impulse is generally periodic, with longer or shorter intervals, while it lasts the individual is irresistibly impelled to steal. As a rule, the desire is directed towards particular objects which are accumulated in large numbers but made no use of. The objects are often worthless in themselves, and of no possible use to the individual. The diagnosis of the real impulsive nature of a theft may be very difficult, the following points will be of assistance. The circumstances of the thief, the character of the articles stolen, the method of disposal. If a well-to-do man is found to have stolen a large number of articles of the same kind, and to have simply accumulated them, making no use of them, Kleptomania may be suspected. If, in addition, he bears the stigmata of mental and bodily degeneration, the diagnosis may be made with considerable confidence.

DIPSOMANIA or impulse to drink is one of the most familiar morbid impulses. It is generally hereditary, and usually periodic in its manifestations. During the intervals, which may extend to years, the individual displays no sign of the craving. The impulse does not, as a rule, immediately overcome the resistance of the will. For some days, the person is out of sorts, restless, sleeps badly, and experiences a desire for stimulants which gradually becomes an irresistable impulse. The attack lasts for days or weeks, during which anything in the shape of alcohol is consumed with avidity. The patient appears not to derive pleasure from his potations. He may lament his condition and attempt to stop, but until the desire passes off he cannot forego drinking any alcohol he can get. The attack ceases after a time, leaving the patient in a condition of bodily prostration and mental remorse.

EROTOMANIA or impulse to sexual gratification is due to the presence in the mind of an imperative obsession which may be manifested in an abnormal desire for ordinary coitus or for some peculiar repulsive form of gratification. The impulse is generally periodic, tending to recur at intervals, the attack lasting days or weeks. The disorder is called NYMPHOMANIA in women, and SATYRIASIS in men; these terms are often also used for symptoms of sexual excitement occurring in ordinary insanity.

Degenerates frequently manifest a perversion of the sexual instinct, due to congenital defects, and not uncommonly combined with impulses. In some, the congenital defect is the determining factor, and in these, the physical appearances are often marked ; men with bodies of a feminine build, broad pelvis, large breasts, hairless, or scanty beard, smooth skin, high pitched voice, feminine features. The mental characteristics correspond and are of a distinctly feminine type. Women exhibit a masculine type of body, the habits and desires of men. These individuals are misfits, a feminine nervous system in a male body ; a woman who is mentally and emotionally a man. Sexual perversion may exist in individuals who are in other respects, mental and physical, normally developed.

It would be absurd to claim that every case of abnormal sexuality was due to a morbid impulse or to congenital perversion of the sexual instinct. In Eastern countries, especially China, Persia and parts of India, unnatural forms of sexual gratification are practised by a very large number of persons. These practices are not considered abnormal, they are the result of vicious habits handed down from time immemorial. Those who indulge in them are responsible for their acts, though as I heard a man say, they do not realize that they are doing anything which should be considered wrong and punishable. This way of looking at acts which European nations abhor, is the result of long established habits.

The victims of sexual perversion are aware of their abnormal disposition, and may be rendered so miserable in trying to struggle against it that they seek escape by suicide. The manifestations of the abnormal condition may range from a comparatively harmless fetichism for articles of female attire to the most revolting practices and even lust murder. A detailed description of the mental condition and the practices of sexual perverts is found in Krafft-Ebing's Psychopathia Sexualis.

DEMENTIA.

Dementia is a condition of decay of the mental faculties after development; it may occur as a primary affection, or secondarily the result of previous disease.

PRIMARY DEMENTIA generally occurs in young persons under thirty years of age, more often in men than in women. Many of the cases start about the time of puberty or shortly after, in consequence of the inability of the organism to provide for the extra demand which the development of sexual functions makes on it. There is, in all cases, an originally weak nervous organization, though up to the onset of the disease, mental development may show no sign of it, and in some instances, the abilities have been above the average, even brilliant.

The manifestations of the disease present the most marked variations; in some the individual, who in youth has given promise of high intellectual development, becomes dull, loses his brilliancy, exhibits a falling off in his work, an inability to understand any subject of an intricate nature, a childishness in his ideas and judgment. He is listless, apathetic, cannot perform any task requiring the exercise of thought and judgment, though he may be able to do work of a routine mechanical character. His physical health is also deteriorated, hypochondriasis is common, digestion is bad, sleep irregular ; he is lazy, disinclined for any exertion.

The symptoms, in manycases, do not progress beyond this stage, and, after a time, there is some improvement, The patient recovers to some extent, but he always remains more or less stupid, with capacity only for a subordinate position. In the more marked types of the disease, the symptoms of mental decay are combined with those of insanity, melancholia or mania, delusions and hallucinations, generally of a vague kind, often persecutory. The conduct is uncertain, assaults on relatives or attempts at suicide arising out of delusions may occur. Erratic tendencies are common. As the disease progresses mental decay becomes more apparent, the patient becomes quiet, apathetic, takes no notice of what is happening around him. He is dull, stupid and indifferent, he rambles in conversation, and is unable to keep his thoughts from wandering. In some cases, answers to questions are given in a few incoherent words. The patient neglects his person, takes no notice of calls of nature, and has to be cared for in every respect.

The disease may progress to complete extinction of the mental faculties, or, at any stage, arrest may occur, the patient remaining in the same state for years or for life.

The physical signs indicate a lowering of the general health, the functions, digestion and circulation, are carried on feebly, temperature is generally subnormal. General sensibility is greatly diminished. In another type of the disease, the patient within a few days of the onset passes into a condition of torpor, mental and physical, the face has an intensely stupid, vacant expression, he remains for hours motionless, or moves his head, or limbs in an automatic manner. He does not speak, or repeats constantly a few words. He shows no sign of comprehending the simplest question or of interest in or of understanding, his surroundings. He has to be fed, clothed, looked after in every way. The physical condition corresponds to the mental, all the functions are carried on in a torpid, feeble manner.

Death may occur from some intercurrent disease, to which the feeble physical condition renders the patient very susceptible. The disease may last weeks and then disappear gradually, recovery may be perfect. The prognosis in primary dementia is generally bad in regard to complete recovery, but arrest of the disease and partial improvement occurs in a considerable proportion of those cases in which the heredity is not of a marked type.

SECONDARY DEMENTIA.

Secondary dementia is a permanent mental deterioration due to previous disease. It is the result of degeneration of the nerve elements, which have been deranged by disease. The occurrence of secondary dementia depends on the type and severity of the preceding disease, and more especially on the inherent qualities of the cortical cells, their power of recuperation and resistance. Some persons pass through repeated attacks of acute insanity without exhibiting appreciable signs of dementia ; in others, a single attack of a not very acute character is followed by dementia. The symptoms of secondary dementia are influenced by the preceding disease, the maniac, who is passing into dementia, exhibits a tendency to excitement, the melancholic is depressed. Delusions of a marked character are present in paranoics, who are becoming demented. The symptoms are consequently extremely varied, but all exhibit a general weakening of the mental faculties, more especially loss of the power of attention, the patient cannot fix his attention, he takes no interest in his surroundings, and is indifferent ; memory, especially for recent events, is very defective, or quite lost. This is explained by the absence of the power of attention, the patient hears and sees without his interest being excited, consequently the mental impression is faint and quickly vanishes. Many of these patients are able to do work of a routine character, but nothing new or calling for the exercise of judgment. Physical health is often good, but they break down readily, and are especially subject to lung and infectious diseases.

In the more marked types of dementia, the mental decay is greater and may extend to a state of almost complete extinction, in which the patient can only follow a simple routine requiring the least possible intellect. Some of the patients are impulsive, excited, chattering constantly. Others are in a stuperose condition. As the process of degeneration extends, attacks of brain irritation may occur, producing a maniacal condition for a time ; after which the decay of the mental faculties is found to be far advanced.

The slighter degrees of mental deterioration are of greater medico-legal interest than the pronounced forms of dementia. It is not infrequently noticed that a person who has gone through an attack of acute insanity, a fever, an attack of alcoholism, or sustained a head injury or a sun-stroke, though apparently completely recovered, is found by friends who knew him intimately before the attack, to have undergone some change, it may be very slight and undefinable, which lead them to consider he is not the man he was. The alteration is in the manner, conduct and power of attention. The patient exhibits an irritability and egoism, a disinclination for work, especially such as is likely to prove annoying, a restlessness and desire for change, an impatience and avoidance of all matters likely to prove disagreeable. In the more decided cases, the mental deterioration is plainly visible in the higher faculties, especially the moral sense, the decay of which may extend to a degree constituting an acquired moral idiocy, without any visible involvement of the intellectual powers. This type of dementia is not infrequent in chronic alcoholic cases and, occasionally, in epileptics.

CHAPTER XXVI.

THE EXAMINATION OF SUSPECTED INSANES.

The examination of a case of suspected insanity may present no difficulty, the disease may be manifest to any one who comes in contact with the patient; on the other hand, in some cases, a diagnosis can only be arrived at after long and close observation by a medical man experienced in mental diseases. There are cases regarding which no definite opinion can be formed, individuals on the borderland between sanity and insanity, at one time, inclined strongly towards insanity, at other times, sane, yet showing by their conduct that their mental organization is in some way abnormal. There are many individuals of whose insanity a medical man, who has examined them, has no doubt, yet owing to the type of the disease, he is unable to certify. The subjects of moral insanity, congenital or acquired, so long as they do not commit crime punishable by the laws, can seldom be certified, and the same may be said of obsessions, impulses and allied conditions.

In the investigation of a case of suspected insanity, the inquiry should include the family and personal history of the patient. As a rule, great difficulty is experienced in obtaining the mental history of a family, partly from want of knowledge, but more from the disinclination to admit that any of the members have been insane; tact and careful wording of the questions, so as to avoid hurting the feelings, will go far in overcoming the reluctance of people to speak of the mental derangements of their relations. In India, it is often impossible to get hold of any one, relation or friend, who can give any information regarding the family of an insane.

The inquiry into the family history should be directed to the parents, grandparents, and collateral relations. The object in view is to discover whether the family exhibits signs of degeneration which may take the form of insanity, or of neuropathic, or of diathetic disorders. Epilepsy, chorea, alcoholism, gout, rheumatism, tuberculosis, are frequently found in the ancestry of the insane. As a rule, mental disorders are not transmitted in the same form from parent to offspring, an exception to this occurs in suicidal impulse and also in dipsomania. Direct homologous heredity of these defects is frequently observed. There are cases on record of suicide by the same means and at the same age in three generations. Dipsomania also exhibits the same tendency.

Atavism or the reappearance of a morbid quality or defect, after a latency of one or more generations is not infrequent, the insanity of a grandparent may show itself in the grandchildren, or even in a later generation.

Insanity never occurs in an individual with a healthy nervous organization, there must be a predisposition or susceptibility which renders him vulnerable to the immediate or exciting causes. This predisposition may be acquired as the result of damage inflicted on the brain by trauma, alcoholism, or disease, especially, the acute infectious disorders, but cases of insanity of this class are comparatively rare, and the vast majority of people who become insane, have inherited a degenerate nervous organisation which may be accompanied by physical as well as mental signs.

The recognition of the physical and mental signs or stigmata of degeneration, is of the greatest assistance in the diagnosis of insanity, and also in the prognosis.

Examination of the Individual.

Before proceeding to the physical and psychic examination of the patient, endeavour should be made to obtain a complete personal history, from childhood up to the present time. The occurrence of convulsions, chorea, epilepsy, and other nervous disorders ; the mental development as shown by the school career, the character and temperament in childhood ; the onset of puberty, the conduct and mental state after sexual development, habits of masturbation, sexual excesses, intemperance in alcohol or drugs ; head injuries, diseases with symptoms of brain involvment ; occupation, mental strain, supposed cause of the insanity, its duration and symptoms. The above are the most important points to which questions, addressed to the relations or friends of the patient, should be directed.

In the examination of a supposed insane, the physician may meet with suspicion and reticence, difficult to overcome. It is not advisable to attempt to deceive the patient by false representation of the subject of the examination, or, of the personality of the examiner. The better course is to endeavour to obtain his confidence, he is then more likely to speak freely and expose the working of his mind.

The physical examination should, as a rule, precede the psychic; this course has the advantage of making the patient feel he is being treated like a sick man, and helps to remove his suspicion and to give him confidence in the examiner. The general aspect and manner should be noted, and the physical stigmata of degeneration looked for.

Much has been written regarding them, and there is no doubt, some alienists have given to them a very exaggerated significance. They may be considered valuable aids in the diagnosis of mental degeneration, but only when taken with more certain symptoms.

The principal stigmata are:—Deformities of the cranium, micro-cephaly, macro-cephaly, abnormal shape of the head, asymmetry of the head and face, deformities of the eyes, nose, mouth, and, especially, of the jaws; the upper jaw may be overdeveloped, projecting; the lower jaw may be large, or abnormally small, harelip, cleft-palate, irregularity and crowding of the teeth. The condition of the palate has received much attention, a narrow, high arch, with a V-shaped summit is the most common type of malformation, met with in degenerates. Special importance has also been assigned to the shape of the ears, absence of the pinna, or of portion of it, abnormal shape, excessive projection, have been found in degenerates, but every deformity described occurs in the mentally sound.

The thorax may be deformed, a funnel shaped chest is often seen in epileptic degenerates. Deformities of the genitals are especially important, infantilism or arrested development of these organs is of frequent occurrence among degenerates.

The skin may be abnormal, mottled, premature wrinkling, excessive sweating of patches, abnormal growth and distribution of the hair, beardless men, bearded women, general asymmetry of the body, fingers too long, or too short, or of disproportionate length.

The above list includes the principal signs of physical degeneration. It is easy to exaggerate their value; they may be present in a person of apparently normal nervous organization, but, there is no doubt, they indicate a condition of defect which is usually shared by the nervous system, and if rightly used, they assist in the diagnosis of the obscurer mental diseases, and, more especially, in the prognosis.

The mental stigmata of degeneration may be referred to briefly; they are conditions of defective intelligence, particularly of the powers of initiation, judgment, and concentration; in some cases, combined with talent in one limited direction. Degeneration is especially shown in the moral sense and in the emotions; there is a hyper-sensitiveness to all impressions, and an absence of the power of resisting suggestions, which render the degenerate a creature of weak will and unstable character. The mental organization exhibits a marked susceptibility to derangement, the manifestations of which, though they follow the forms of the different varieties of mental disorder, are all coloured by the degenerate mind, just as the course of an ordinary disease in a hysterical patient is influenced by the hysterical basis.

The state of the general health should be noted, digestive disorders are common among insanes. Trophic disorders occur in some forms of insanity, one of these is common, *viz.*, the insane ear, a blood tumour in the external ear, usually the left. It is probably caused by slight violence, but is essentially due to trophic changes. The blood is reabsorbed, but marked deformity is left.

The physiognomy of the patient should be studied; in pronounced forms of insanity, the existence and even the type of the the disorders may be apparent in the expression. The dress, gait and manner of the patient should be noted. Movements of the hands, fingering certain parts of the body or clothes, odd gestures and various slight peculiarities are often present. Neglect of the person and filthy disgusting habits are common in some forms of insanity, but, as a rule, not in the varieties which are difficult to diagnose.

PSYCHIC EXAMINATION.

The questions to be asked and the manner of wording them must be left to the knowledge and experience of the examiner.

They should be appropriate to the position and possible degree of culture of the patient. They should be directed towards drawing from him a complete account of his thoughts, feelings and desires. The standard by which a man's sanity is to be judged is the normal condition of his mind, what it was before it became deranged. The object of the examination is to detect the character and extent of the alterations which have taken place, and their effect on his thoughts, feelings, conduct and reason. As a rule, the variation from the individual's normal state is marked and readily recognised, but there are cases in which long and minute observation is required, and others which always remain doubtful, even to the most experienced alienist.

It is advisable in all cases to examine the patient several times and to observe him unawares. Many insanes are able to conceal their insanity for a time, even for weeks. Great assistance will be found, in these cases, by inducing the patient to write an account of himself; many who are able to control themselves in conversation, expose the disordered state of their mind in writing. It is useful also to compare the present handwriting with that of the patient's normal state, changes are often found.

The existence of hallucinations and illusions may be detected from the attitude or gestures. The patient may stop suddenly in the middle of a sentence or in his walk and assume an attitude of listening. His face may have an expression of fear or of pleasure according to the nature of the hallucination. Visual, gustatory or olfactory hallucinations may also be indicated by the manner of the patient.

Delusions are sometimes very difficult to discover. A case may be under observation for weeks or even months, before the existence of a delusion is revealed.

It is not to be understood that hallucinations and delusions are always, or even generally, difficult to discover. It is not so, in most insanes they are readily made out, and even when, at first, the patient is suspicious and on his guard, an experienced examiner, proceeding carefully, will before long obtain evidence of their existence. The delusions most difficult to discover are those of a persecutory character, such as occur in paranoia. The delusions of the later stage of that disease may also be concealed, but, as a rule are indicated by the conduct of the patient. Morbid impulses, suicidal, homicidal, are often completely concealed, and not discovered until carried into effect, unless voluntarily disclosed by the patient.

It may be pointed out that insane persons may simulate a form of insanity different from that they suffer from. Criminals may feign insanity to escape the consequences of their crime, and prisoners not infrequently pretend to be insane to avoid disagreeable tasks or for other reasons. The imposture is sometimes carried out with great cleverness, requiring careful and prolonged observation for its detection. As a general rule, the impostor overacts the part. If he pretends to be a maniac, he exhibits extreme violence and in a few hours is completely worn out, whereas, a true maniac may go on, in a state of violent excitement, for days. The impostor nearly always mixes up the symptoms of different forms of insanity, gives absurd answers to every question and constantly seeks to give evidence of his insanity.

Though in many cases, the existence of insanity is apparent to everyone, it is advisable for a medical man to decline to give an opinion or to certify, until he has had the patient under observation for some days. This course may cause inconvenience and trouble to friends, but it is a good rule, and may prevent mistakes of a kind that may subsequently entail much annoyance and expense to the medical man. Moreover, he is expected to be able to give the probable course, duration, and termination of the disease, which necessitate an insight into the case, not to be obtained in one or two interviews. Of course there are cases for which, owing to the violent character of the symptoms, immediate removal to an asylum is necessary. Such cases must be certified promptly.

In all difficult cases, the examiner should act with great caution ; a mistake, in the diagnosis of the mental condition of an individual, may lead to most serious consequences ; on the one hand, it is a grave step to declare anyone to be an insane ; on the other, failure to recognise mental disorder may be attended with fatal consequences to the insane ; or to those around him. There are cases of insanity in which the disease, though real, is not obvious, and the most skilled alienists are unable to give satisfactory proof of its existence.

When an individual is under observation as to the state of his mind, it is advisable to take notes in writing of the symptoms observed at each interview. They constitute a clinical record of the case, and may prove of great importance should the correctness of the opinion arrived at be subsequently questioned and over haste or carelessness imputed to the examiner.

CHAPTER XXVII.

MEDICO-LEGAL RELATIONS OF INSANITY.

Insanity differs from other diseases in that the patient may be incapacitated for the exercise of his civil and legal rights. An insane person may be deprived of his liberty, of the management of his affairs, of his testamentary capacity, and if he commits a criminal offence, he may be held irresponsible for his act.

Seclusion of Insanes.

An insane person may be legally restrained from injuring himself or others, or from damaging his own property or that of others. He is not considered to be a free agent, and may be placed in an asylum for care and treatment. Some judges have held that no person ought to be confined in an asylum unless he is dangerous to himself or to others, but the Commissioners of Lunacy, in England, point out that "the object of the Lunacy Acts is not, so much to confine lunatics, as to restore to a healthy state of mind such of them as are curable, and to afford comfort and protection to the rest. Moreover, the difficulty of ascertaining whether one who is insane be dangerous or not is exceedingly great and in some cases can only be determined after minute observation for a considerable time."

In Act No. 36 of 1858 which relates to the reception and detention of lunatics in asylums, it is not stated that a lunatic may be sent to an asylum for treatment, but throughout the act and in the certificate form A in the schedule the words "a proper person to be detained under care and treatment" occur, from which it may be inferred that treatment is contemplated in addition to detention.

Lunatics can only be received into an asylum on the following conditions :—

1. If by the order of a Magistrate, Commissioner of Police or civil court, with one medical certificate, Form A in the schedule of the Act, granted by a medical officer who has examined the lunatic.

When the lunatic is sent to the asylum a certificate, in duplicate, by the Civil Surgeon, in Executive New No. 88 Form, of the lunatic's physical health and fitness for removal, and one copy of medical history sheet of lunatics, Government of Bengal Executive Form No. 90, must be forwarded with the certificate Form A.

2. In the asylums of the Presidency towns, a lunatic may be received on the requisition of a relative or guardian, in the Form B in the schedule of the Act, together with such statement of particulars as is contained in the said Form B, and the medical certificate Form A of two persons, each of whom shall be a physician or surgeon and one of whom shall be a Presidency Surgeon or a Surgeon in the employment of Government.

It is advisable that the medical men giving the certificates should examine the patient independently of one another, within seven days of the presentation of the requisition. According to the English Lunacy Acts, they must not be partners, nor one the assistant of the other, nor connected with one another, nor with the person who signs the requisition, nor with the proprietor, if the lunatic is to be sent to a private asylum.

In filling in the certificate form A. all particulars should be carefully entered. The name, medical qualifications, or official designation of the certifier ; the date and place of examination ; the name and residence of the lunatic.

In the body of the certificate, under the heading "*1st*, Facts indicating insanity observed by myself," the certifier should give a clear, concise account of the signs and symptoms upon which the diagnosis is based. If the patient has delusions, they should be stated in his own words. Some delusions are self-evident, as for example, the belief that he is a god ; others are not, such as the patient says he has lakhs of rupees, it is necessary to add, which is a delusion.

The certifier should recollect that his certificate must contain a statement of the facts which justify the opinion that the patient is insane and a proper subject for confinement, and the reasons given should be such as will convince others of the correctness of the opinion.

According to the English Lunacy Acts, the facts entered must have been observed on the day the certificate was given ; though not laid down in Act 36 of 1858, it is advisable to follow the same practice in India.

Under the heading, "*2nd*, Other facts (if any) indicating insanity communicated to me by others," the full name and address of the persons who give information should be entered, and their statements recorded in their own words.

Incapacity of an Insane to manage his Affairs.

An insane person may be declared by a Court to be incapable of managing his property or business. The procedure followed is laid down in Act 34 of 1858 for lunatics subject to the jurisdiction of the Charter Courts, and in Act 35 of 1858 for lunatics subject to mofussil Courts.

On application the Court authorises an inquiry to be instituted for the purpose of ascertaining whether an alleged lunatic is or is not of unsound mind and incapable of managing his affairs. Application for such inquiry may be made by a relative, or by the Advocate-General, or by any public curator, or by the Government pleader, or if the property of the lunatic is wholly or partly of land, by the Collector of the District in which it is situate. Notice of the inquiry must be given to the alleged lunatic. The Court may examine him and may also direct his examination by a medical man or any other person.

In these cases the medical man should direct his examination firstly, towards determining whether the person is insane or not, and secondly, if he be insane, whether his insanity renders him incapable of managing his affairs.

An individual may be insane and yet capable of managing his business; paranoics have carried on extensive business affairs for years without showing any sign of mental incapacity; moral insanity is compatible and not infrequently combined with good mental powers.

The report of the medical man who examines an alleged lunatic as to his capacity for managing his affairs, should contain a clear description of the mental condition, and of the exact nature of the unsoundness of mind and its effect on the capacity of the individual.

Contracts by Lunatics.—" A person is said to be of sound mind for the purpose of making a contract if, at the time he makes it, he is capable of understanding it and of forming a rational judgment as to its effect upon his interests" (Indian Contract Act, s. 12). A contract made by a lunatic may be binding provided it is of a fair and reasonable character, and that the other party was not aware that he was dealing with a lunatic. The question of the validity of a consent given by an insane may arise, section 90 of the Indian Penal Code states: "A consent is not such a consent as is intended by this code, if the consent is given by a person who, from unsoundness of mind or intoxication, is unable to understand the nature and consequences of that to which he gives his consent."

TESTAMENTARY CAPACITY OF THE INSANE.

Insanity, in itself, does not invalidate a will, provided the testator understands the nature of the act and its effects, and is not prevented by the diseased state of his mind from disposing of his property in a rational manner, nor induced by the mental disorder to make a disposal of it which would not have been made had his mind been sound. The law, in dealing with the will of an insane, is much more influenced by the character of the will than by evidence of the mental disorder of the testator. If a will is rational, consistent, free from insane prejudice and from signs of undue influence having been brought to bear on the testator, it will be upheld, though the insanity of the testator be proved.

A medical man may be asked to examine a person and to certify his capacity to make a will. The duty is one of great importance. The medical man should satisfy himself as to the identity of the person he is about to examine; he should carefully note the character of any symptoms of mental disorder that may be present and their effect on the memory, understanding, and will of the person. He should question the testator as to the extent of his property and the disposal of it. The testator should know, approximately, the nature and extent of his property; he should be able to name the principal legatees and to describe their claims upon his bounty.

It is very important to discover whether the answers of the testator are free or dictated by others. Persons of feeble mind not infrequently fall under the sway of stronger minds, and are induced to make wills which are contrary to their real wishes. If any suspicion arises that the answers of the testator do not express his real sentiment he should be seen alone and encouraged to speak freely.

Criminal Responsibility of Insanes.

A person, who is suffering from insanity, is not, on that account, considered irresponsible for his acts, unless the disease of his mind is of such quality as to bring him under section 84 of the Indian Penal Code which lays down—" Nothing is an offence which is done by a person who, at the time of doing it, by reason of unsoundness of mind, is incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law."

It is evident from the wording of this section that to successfully establish the defence of unsound mind, it is not sufficient to show that the accused was insane. It must be proved to the satisfaction of the court that at the time he committed the offence with which he is charged, he was, by reason of unsoundness of mind, incapable of knowing the nature of the act, or that what he did was either wrong or contrary to law. It is also apparent that the legal tests of responsibility are knowledge of right and wrong, and of the nature of the act. If we apply these tests to individuals suffering from the various forms of mental disease described in preceding pages, the conclusion is, inevitably, that most insanes are responsible for their acts and that few come under section 84 of the Indian Penal Code. It is only in extreme forms of mania, melancholia, dementia, idiocy and other diseases that the knowledge of right and wrong and of the nature of acts is lost ; the great majority of insanes possess it, what they have lost is the power to choose the right and avoid the wrong. The law does not take cognisance of the power of personal restraint which, in insanes, is often weakened to an abnormal degree, nor of the existence of irresistible impulses or obsessions, nor of moral insanity. Even the existence of a delusion would not exempt from punishment, unless it prevented the individual from knowing the nature of his act, or that what he did was wrong and contrary to law. If a man, under a delusion that his life is being attempted by another, kills his assailant, he is held to be irresponsible for his act inasmuch as he acted in what he believed to be self-defence. But if he killed a man, under the delusion that the deceased had libelled or defrauded him, he would be held responsible, for in this case even were his delusion true he would not be justified in killing the person who had libelled or defrauded him. Paranoics commonly suffer from delusions of persecution without other sign of mental disorder; they are capable of appreciating the nature and consequences of their acts. A common delusion, in this form of insanity, is the belief that a certain person is circulating reports of an injurious character, or is constantly engaged in damaging the patient's prospects in some way. The delusions often lead to murderous assaults, and it would appear that in accordance with the wording of section 84 of the Indian Penal Code and the law in England, as shown in the answers given by the judges to the questions put to them by the House of Lords, these insanes are criminally responsible. Fortunately the question of the responsibility of an insane criminal, in all serious cases, is decided by a jury, the members of which form their own opinion of the mental condition of the prisoner from the evidence, general and medical, placed before them, and it seldom happens, except in times of popular excitement, or when some prominent personage falls a victim to the murderous assault of a lunatic, that there is a failure of justice.

When an individual accused of a crime appears to the Magistrate holding the inquiry or trial, or to the judge in a case committed to the sessions, to be of unsound mind, the first question to be decided is, whether the accused is, at the present time, of unsound mind and consequently incapable of making his defence. A medical officer is directed to examine the accused as to the state of his mind, his evidence and that of other witnesses is recorded. The medical man having ascertained by careful examination the state of mind of the accused at the present time, places the facts before the court, and if questioned gives his opinion, but the medical witness should recollect that the decision rests with the court which is free to accept or reject his evidence. If the court finds the accused of sound mind and capable of making his defence, the inquiry or trial proceeds;

if the finding is that he is of unsound mind and incapable of making his defence, the case is postponed until he has recovered.

When the accused is in a condition to stand his trial and make his defence, the case is gone into in the usual manner. The first point to be decided is—Did the accused commit the act with which he is charged ? If the finding is in the affirmative, the next question is the state of his mind at the time of the occurrence ; was he by reason of unsoundness of mind, incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law ?

Medical evidence as to the state of mind of the accused at the time of the occurrence is taken. It rarely happens that the accused was examined on the day of the occurrence by a medical man, not infrequently days elapse before the examination. The duty of the medical witness is to carefully examine the accused, and to place before the court a clear and accurate description of the signs and symptoms of mental disease found. He may be asked to give his opinion of the prisoner's state of mind but in some courts the question is not allowed, and the medical witness is confined to stating the facts observed. In a case before Mr. Justice Day a medical man stated, he had examined the accused on a certain date, and counsel put the question : Was he sane or insane on that date ? The question was disallowed on the ground that experts were not to be asked their opinion on subjects which it was the function of the jury to decide.

A medical witness may be required to hear the evidence of other witnesses, and he may be asked whether certain facts and symptoms, assuming them to be proved, indicate insanity.

The important question, *viz.*, was the accused by reason of unsoundness of mind, incapable of knowing the nature of his act, or that what he was doing was wrong or contrary to the law, is decided by the jury, and a medical witness should carefully avoid encroaching on their prerogative ; he must answer every question which is allowed to be put, fully, clearly and without bias.

The following case contains an authoritative statement of the law regarding the criminal responsibility of insanes and also shows the procedure adopted in the trial of persons who have committed an offence while insane.

On the 19th July 1900, a soldier killed a derzie. A Coroner's inquest was held, a verdict of murder was brought in, the accused was placed before a magistrate who, after inquiry and recording the evidence, committed him to the sessions. During the inquiry before the Magistrate, the solicitor for the defence set up a plea of insanity. After the case was committed to the sessions, a correspondence passed between the Government Solicitor and the solicitors of the accused, which resulted in three medical officers being directed to examine the accused as to the state of his mind. When the case came on for hearing, at the sessions, the fact that the sanity of the accused was doubted was made known to the presiding judge, and His Lordship, after putting some questions to the accused to test the state of his mind, directed a jury to be empanelled to decide whether he was of unsound mind, and secondly incapable of making his defence.

The three medical officers who had examined the accused gave evidence, and were cross-examined by counsel for the defence.

After hearing counsel for the defence, His Lordship summed up, and the jury found that the accused was insane and incapable of making his defence. His Lordship said that the case would be reported to Government, the prisoner remanded to jail and the trial postponed *sine die*.

Under orders of Government, the accused was sent to a lunatic asylum for safe custody. In May 1901, he was reported sane and capable of making his defence. His trial came for hearing at the sessions court on the 21st of the same month. The prisoner pleaded not guilty, and the trial proceeded. It is unnecessary to describe the evidence, it suffices to say that the fact that the crime was committed by the accused was clearly shown.

After the addresses of counsel for the defence and for the prosecution, His Lordship summed up. He first pointed out what it was the jury were called on to decide. They had to decide, in the first place, whether the prisoner committed the act with which he was charged, did the prisoner by shooting the derzie kill him and did he shoot him with the intention of causing death. It was only when they came to the affirmative on that question that it was necessary for them to determine the question what the mental state of the prisoner was, at the time he committed that act. If the jury thought it was not the prisoner who shot the derzie, or supposing they came to the conclusion that the act was not done with the intention of killing, then there could be no murder, and there being no murder, it was unnecessary for them to consider whether the prisoner was sane or insane at the time he committed the act.

His Lordship referred to the evidence of eye-witnesses, the prisoner's admission immediately after the crime that he had fired and caused the death of deceased ; and continued, if the jury thought it was the act of the prisoner which caused the death of the deceased, they had next to judge of the intention of the prisoner in doing that act. The knowledge and intention of the prisoner were matters which would be determined by the surrounding circumstances. In law a man was supposed to know the natural consequences of his own act. So when they saw a man deliberately taking a rifle and aiming it at a vital portion of another man, they might rightly presume that he deliberately intended to kill that person. There was no power on earth to pierce the brain of an individual to judge what his motive might be. The only way left to persons to judge of knowledge or intention, was to see what the facts were in connection with the matter and to judge from those facts.

If the jury came to the conclusion, apart altogether from the question of sanity or insanity of the prisoner, that he committed the act and apprehended the consequences of that act, then the offence would be murder. Then arose the question which was really the matter the jury had to decide. The question was whether at the time the prisoner committed this crime he knew what the nature of that act was, or knew whether it was right or wrong.

The question which was thus put to the jury was not as simple as it would appear to be. No doubt at first sight it seemed to be a very simple matter to say when a man committed a particular act that he knew the nature of it, or must be taken to know whether it was right or wrong, but when they began to consider the circumstances which attended this act, both as regards the disposition of the individual and the circumstances under which it was done, the question became a very complex one. In this case the jury would be relieved of a good deal of the complexity attached to a question of that sort. His Lordship did not think that anybody who had heard the evidence given in this case of the personal history of the prisoner, both as regards himself and other members of his family, his physical health, the fits of epilepsy, the outbursts of violence which marked his conduct from time to time, the circumstances under which the act was done, the absence of any sort of adequate motive, the absence of an accomplice—all these matters taken together could not but produce the strongest impression on a fair-minded person that the prisoner could not have been possessed at that time of a sane mind. So far the jury might think the evidence led to no difficulty, it all went to show that the prisoner was not exercising the ordinary powers—qualities—which a sane man exercised. But though that might be so, the real question the jury had to determine was this: Assuming that the prisoner was perfectly deranged at that time, was that insanity of mind such as, according to the law of this country, rendered a person criminally irresponsible? Having regard to the disposition of the mind of the prisoner, was it such as would render him criminally irresponsible as regards the act he was charged with.

Having read the section dealing with the matter His Lordship went on to say what he took to be the meaning of the language of the section was this: That what the law said was that the general question of unsoundness of mind was immaterial, unless that unsoundness of mind showed that by reason of it a person did not know the nature of the act he had committed, or did not know that it was wrong. It said that a person might suffer from delusions of all kinds, but so long as he had no delusions upon either of these points, he was responsible. There must be no delusion as to the nature of the act he was doing; no delusion as to whether that act was right or wrong. If there was no delusion upon either of these two matters, then a person was criminally responsible. A person might have delusions as to where he was and as to manner, but yet if that delusion did not overcloud his judgment or reason so as to prevent him from appreciating what the act was which he did, or that the act which he did was a wrong act in point of law or morals, then he was responsible. And in effect what the law did was to say it had nothing to do with general delusions of unsound mind. Did the prisoner know the nature of the act he had committed? If he did, did he know it was wrong? If either of these facts were found, then the law of this country was that he was responsible.

His Lordship explained that the law was the same in England; though the law had been differently applied, yet the principles laid down were precisely the same both here and at home.

His Lordship referred to the facts as suggested by the prosecution, and asked whether it was sufficient that on the 21st August last when the first stage of this trial was held that the prisoner was then of unsound mind in the sense that his reason was affected? There could be no doubt that at that particular time the prisoner would have come strongly within the words of the section which his Lordship had read, because there was insanity of mind extending to his replies. The real question was this—whether that unsoundness of mind was of an unsound character on the 19th July, when the prisoner committed the offence. His Lordship then read a passage from the judgment of two judges and said the meaning of it was that supposing that criminal irresponsibility was extended to any form of unsoundness of mind it would remove a safeguard and incentive to people to control their impulses. The question was whether the prisoner knew the nature of the act he did and whether it was right or wrong. Taking the issue in that form His Lordship proposed to call their attention to the evidence upon one side and upon the other. After stating very briefly the case for the prosecution, His Lordship said that the first question which naturally occurred was how far they were to accept the evidence for the prosecution as satisfactorily established. His Lordship asked the jury to turn to the other side of the picture. Could the prisoner at that time form a rational judgment, or was he in a position to form a rational judgment as to the nature of his act? Rational judgment, his Lordship presumed, meant having the power of reason which would enable the prisoner to recollect the nature of the particular act he committed and to appreciate the moral character of that act. It was not necessary to say that a man in committing an act of this kind should be conscious of its moral heinousness as a man who had been differently brought up and educated would have of it. A man who had been brought up among brutal surroundings, for instance, would think less of taking the life of a man than one who had been brought up under refining influences. It was not, therefore, necessary for the jury to say that this man should have the same moral consciousness of the act as another man. The evidence had shown that the prisoner was mentally deranged, and that on the 21st August he was so deranged that the insanity had affected his reasoning faculties and he was unable to appreciate what was going on round about. There was also the medical evidence that so far as the doctors knew the mental condition of the prisoner then was very nearly the same as on the day following the occurrence. There was also the fact that two witnesses deposed to the delusion under which the prisoner laboured on the very morning of the occurrence, namely that he was Captain Western of the Gordon Highlanders, and that his mother Lady Rossmore, had sent him money which was in his box and which he wanted one of the witnesses to take out and treat the whole of the guard. There was one circumstance regarding the evidence of these two witnesses and it was this : it was certainly singular that, if these statements—and very important statements they were—were made at this time, that nothing should have been heard of them in the inquiry which Major Brown made immediately after the occurrence. The witnesses explained that they did not hear of the inquiry. It was certainly singular that this inquiry which would be generally known in the regiment should not be known to these two men, and these statements should have been made for the first time, except to the attorney for the prisoner in the witness box. His Lordship did not for one moment say that necessarily, on that ground, the jury should reject this evidence. The jury must weigh it cautiously, and if they thought they could place any reliance upon it, should accept it. It might be that the prisoner was working under this delusion and that working under this delusion he committed this offence. It might be that working under that delusion the prisoner's reason was for the time unsound, that he went in a trance to the place of the occurrence, that he shot the Master Tailor in a way he could not account for, and hearing that the Master Tailor had been murdered and that he shot the man, it might be that in his dazed state he regarded the facts as true and having assumed that they were his own, as had been suggested by Counsel, said "I have shot the Master Tailor and want to be taken to the guard-room." It might be that the prisoner committed the act at a time when he did not know what he was doing, that the charge brought him to his senses, and that afterwards he found out what it was. What his Lordship did ask the jury was not to rely upon any particular portion of the evidence. The safest and wisest course was to take the evidence as a whole and, if they thought in this case, that the natural and fair result of the evidence was that the prisoner did not know what he was doing at the time he shot the Master Tailor, notwithstanding his independent admission, then it would be the duty of the jury to find him not guilty of the offence with which he was charged.

In conclusion His Lordship said that the real question was this: Was prisoner's mind so far unsound as to prevent his having an appreciation of the consequences and effects of his act of the 19th July 1900? If the jury came to the conclusion that the offence was *primâ facie* murder, they would then consider whether by reason of unsoundness of mind the prisoner did not know the nature and the consequences of his act or that it was wrong. They must in their verdict say whether the prisoner committed the act with which he was charged and having committed that act —if they found that he did not know the nature of the act or that it was wrong—they would find he was not guilty on the ground of unsoundness of mind. If, on the other hand, the jury found that the prisoner did know he was killing the man and that it was wrong, then it would be their duty, however painful it might be, to return a verdict of guilty.

The jury retired, and after an absence of about five minutes returned and delivered the following unanimous verdict: We find that the prisoner committed the act with which he is charged but is not guilty by reason of unsoundness of mind.

His Lordship addressing the prisoner said: "I direct that you be detained in jail pending the orders of the Local Government."

The procedure followed in cases similar to the above is laid down in sections 464 to 475 of the Code of Criminal Procedure.

APPENDIX.

CIRCULAR No. 55.

MEDICAL EVIDENCE.

1st February 1864; 4th March 1892. (Modified and consolidated).

When a case arises requiring Medical opinion, the Police officer should forward the subject to the Medical Officer,* with such a general description of what is known of the case that the attention of the Medical Officer may be turned in the right direction. A printed form is provided for the purpose, and should always be used. The reference may be made in English or in the vernacular, as the case may be.

2. The result of the Medical Officer's examination, together with his opinion on the case, will be entered in that part of the printed form provided for the purpose, and the form so filled up will be returned to the Police.

3. The Police office, having received the report of the Medical Officer, will send up the case according to rule to the Magistrate, sending with the *chalan* the form containing the reference to the Medical Officer and his reply thereto. On the list of witnesses will appear the name of the Medical Officer.

4. The only use of the Medical Officer's report will be to assist the Police in getting up the case, to refresh the memory of the Medical Officer at the time of giving his deposition, and to aid the Judicial Officer in framing his queries. It cannot be admitted as evidence (except under clause (2), Section 32 of the Evidence Act); nor is it sufficient to read it over to the Medical Officer and swear him to the truth of it; his deposition must be recorded *de novo* and at length in the presence of the accused. The Magistrate should therefore look into the case and make himself acquainted with its particular features before the Medical Officer enters the Court, in order that the proper questions may be asked.

5. Care should always be taken to record the medical evidence so fully and intelligently as to render a second examination of the witness by another Court unnecessary.

6. With a view of assisting Magistrates in the task of asking suitable questions, a list of questions which suggest themselves in each class of cases is appended, to which the Magistrate can refer at the time of the examination.

7. Before the Medical Officer leaves the Court his deposition is to be fully interpreted to the accused, who is to be allowed to cross-examine. In order to ensure that the Medical Officer's deposition may in all cases be admissible under Section 509, Criminal Procedure Code, the Magistrate must sign at the foot of it a certificate in the following form:—

> "The foregoing deposition was taken in the presence of the accused, who had an "opportunity of cross-examining the witness. The deposition was explained "to the accused, and was attested by me in his presence."

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* Where a *post mortem* examination is necessary, the corpse will be forwarded to the nearest Civil Surgeon or other Medical Officer appointed in this behalf by the Local Government under Section 174, Code of Criminal Procedure.

This is, of course, specially necessary when the deposition is taken in an inquiry preparatory to commitment to the Sessions.

8. Whenever a Medical Officer is examined as to the result of his examination of any person, corpse or substance, evidence should always be taken to prove that the person, corpse or substance examined by him, and to the examination of which he testifies, is the person, corpse or substance in question in the case.

9. For this purpose the evidence of the persons conveying the corpse or substance to the Medical Officer should be taken; and in cases where the examination by the Medical Officer of a living person is in question, the identity of the person examined by him with the person in question in the case should be placed beyond doubt by actual identification in Court if the person is able to be present, and if not, by the evidence of the person who conducted him to the Medical Officer.

10. If in any particular case the evidence of a medical witness is not to be had, the details, such as fact of death, symptoms, appearances, wounds, must be made out as correctly as possible from the evidence of non-professional eye-witnesses. The Courts cannot assume any such facts from mere reports, not admissable as evidence. Police Officers can always be put into the witness box to bear witness to what they saw.

No. I.

Questions which may be put to a Medical witness in a case of suspected Poisoning, after post mortem *examination of the body.*

1. Did you examine the body of———————————— late a resident of——————————and, if so, what did you observe?

2. What do you consider to have been the cause of death? State your reasons.

3. Did you find any external marks of violence on the body? If so, describe them.

4. Did you observe any unusual appearances on further examination of the body? If so, describe them.

5. To what do you attribute those appearances—to disease, poison, or other cause?

6. If to poison, then to what class of poisons?

7. Have you formed an opinion as to what particular poison was used?

8. Did you find any morbid appearances in the body besides those which are usually found in cases of poisoning by——————————? If so, describe them.

9. Do you know of any disease in which the *post mortem* appearances resemble those which you observed in this case?

10. In what respect do the *post mortem* appearances of that disease differ from those which you observed in the present case.

11. What are the symptoms of that disease in the living?

12. Are there any *post mortem* appearances usual in cases of poisoning by————————————————————, but which you did not discover in this instance?

13. Might not the appearances you mention have been the result of spontaneous changes in the stomach after death?

14. Was the state of the stomach and bowel compatible or incompatible with vomiting and purging?

15. What are the usual symptoms of poisoning by——————————

16. What is the usual interval between the time of taking the poison and the commencement of the symptoms?

17. In what time does——————————————————generally prove fatal?

18. Did you send the contents of the stomach and bowels (or other matters) to the Chemical Examiner?

19. Were the contents of the stomach (or other matters) sealed up in your presence immediately on removal from the body?

20. Describe the vessel in which they were sealed up; and what impression did the seal bear?

21. Have you received a reply from the Chemical Examiner; if so, is the report now produced that which you received?

22. (If a female adult) What was the state of the uterus?

No. II.

Questions that may be put to non-professional witnesses in a case of suspected Poisoning.

1. Did you know————————late a resident of ? If so, did you see him during his last illness and previously?

2. What were the symptoms from which he suffered?

3. Was he in good health previous to the attack?

4. Did the symptoms appear suddenly?

5. What was the interval between the last time of eating or drinking and the commencement of the symptoms?

(If death occurred.) 6. What was the interval between the commencement of the symptoms and death?

7. What did the last meal consist of?

8. Did any one partake of this meal with————

9. Were any of them affected in the same way?

10. Had————ever suffered from a similar attack before?

If any of the following symptoms have been omitted in answer to question 1, special questions may be asked regarding them as follows.

11. Did vomiting occur?

12. Was there any purging?

13. Was there any pain in the stomach?

14. Was———very thirsty?

15. Did he become faint?

16. Did he complain of headache or giddiness?

17. Did he appear to have lost the use of his limbs?

18. Did he sleep heavily?

19. Had he any delirium?

20. Did convulsions occur?

21. Did he complain of any peculiar taste in the mouth?

22. Did he notice any peculiar taste in his food or water?

This is with reference to Nux Vomica.

23. Was he sensible in the intervals between the convulsions?

This is with reference to Aconite.

24. Did he complain of burning or tingling in the mouth and throat, or of numbness and tingling in the limbs?

No. III.

Questions which may be put to a Medical witness in a case of supposed Death by wounds or blows after post mortem *examination of the body.*

1. Did you examine the body of————, late a resident of ————and, if so, what did you observe?

2. What do you consider to have been the cause of death? State your reasons.

3. Did you find any external marks of violence on the body? If so, describe them.

4. Are you of opinion that these injuries were inflicted before or after death? Give your reasons.

5. Did you examine the body internally? Describe any unnatural appearance which you observed.

6. You say that in your opinion————was the cause of death; in what immediate way did it prove fatal?

7. Did you find any appearance of disease in the body?

8. If so, do you consider that if the deceased had been free from this disease, the injuries would still have proved fatal?

9. Do you believe that the fact of his suffering from this disease lessened his chance of recovery from the injuries sustained?

10. Are these injuries taken collectively (or is any one of them) ordinarily and directly dangerous to life ?

11. Have they been caused by manual force or with a weapon ?

12. Did you find any foreign body or foreign matter in the wound ?

13. By what sort of weapon has the wound been inflicted ?

14. Could the injuries have been inflicted by the weapon now before you (No.————Article in Evidence) ?

15. Could the deceased have walked (*so* far) or spoken, &c., after the receipt of such an injury ?

16. Have you chemically or otherwise examined the stains (on the weapon, clothes, &c.) now before you (No.——Article in Evidence) ?

17. Do you believe the stains to be those of blood ?

18. What time do you think elapsed between the receipt of the injuries and death ?

19. What was the direction of the wound, and can you form an opinion as to the position of the person inflicting such a wound with respect to the person receiving it ?

20. Is it possible for such a wound to have been inflicted by any one on his own person ? Give your reason.

(In gunshot wounds.) 21. Give the precise direction of the wound.

22. Did the appearances of the wound indicate that the gun had been discharged close to the body or at some distance from it ?

23. Did you find any slug, bullet, wadding, &c., in the wound or had———made its exit ?

24. Do you think it possible that you could have mistaken the aperture of entrance for that of exit ?

No. IV.

Questions that may be put to a Medical witness in a case of supposed Infanticide, after post-mortem *examination of the body.*

1. Did you examine the body of a $\frac{\text{male}}{\text{female}}$ child sent to you by the District Superintendent of Police on the——of——18 , and if so what did you observe ?

2. Can you state whether the child was completely born alive, partially born alive, or born dead ? State the reasons for your opinion.

3. What do you consider to have been the cause of death ? Give your reasons.

4. What do you believe to have been the uterine age of the child ? State your reasons.

5. What do you believe to have been the extra uterine age of the child? Give reasons.

6. Did you find any marks of violence or other unusual appearances externally? If so, describe them accurately.

7. Did you find any morbid or unusual appearances on examination of the body internally? If so, describe them accurately.

8. Do you believe the injuries you observed to have been inflicted before or after death? Give reasons.

9. Can you state how they were inflicted? Give reasons.

10. Do you consider that they were accidental or not? Give reasons.

11. Had the infant respired fully, partially, or not at all?

12. Did you examine the person of——the alleged mother of the infant? If so, have you reason to suppose that she was recently delivered of a child? Can you state approximately the date of her delivery? Give reasons.

No. V.

Questions that may be put to a Medical witness in a case of supposed Death by hanging or strangulation.

1. Did you examine the body of————————late a resident of——————and, if so, what did you observe?

2. What do you consider to have been the cause of death? State the reasons for your opinion?

3. Did you observe any external marks of violence upon the body?

4. Did you observe any unnatural appearances on examination of the body internally?

5. Was there any rope or other such article round the neck when you saw the body?

6. Can you state whether the mark (or marks) you observed were caused before or after death?

7. By what sort of articles do you consider the deceased to have been hanged (or strangled)?

8. Could the mark you observed have been caused by the rope or other article now before you (No.———Article in Evidence)?

9. Do you think that this rope could have supported the weight of the body?

(If strangulation.) 10. Would great violence be necessary to produce the injuries you describe?

No. VI.

Questions that may be put to a Medical witness in a case of supposed Death by drowning, after post mortem *examination of the body.*

1. Did you examine the body of———————————late a resident of———————————and if so, what did you observe ?

2. What do you consider to have been the cause of death ? State your reasons.

3. Were there any external marks of violence upon the body ? If so, describe them.

4. Describe any unnatural appearances which you observed on further examination of the body.

5. Did you find any foreign matters, such as weeds, straw, &c., in the hair, or clenched in the hands of the deceased, or in the air passages, or attached to any other part of the body ?

6. Did you find any water in the stomach ?

No. VII.

Questions that may be put to a Medical witness in a case of alleged Rape.

1. Did you examine the person of Mussamut——————— ? If so, how many days after the alleged rape did you make the examination, and what did you observe ?

2. Did you observe any marks of violence about the vulva or adjacent parts.

3. Are these injuries such as might have been occasioned by the commission of rape ?

4. Was the Hymen ruptured ?

5. Did you observe any further marks of violence upon the person of the woman ?

6. Had she passed the age of puberty ?

N. B.—This question only to be asked in the case of the rape of a girl of tender years.

7. Can you state approximately what her age is ?

8. Did you find her to be a strong healthy woman, or so weakly as to be unable to resist an attempt at rape ?

9. Did you examine the person of the accused ?

10. Did you observe any marks of violence upon his body ?

11. Was he suffering from any venereal disease ?

12. Did you find the woman to be suffering from a similar or other venereal disease ?

13. Had a sufficient time elapsed, when you examined the person of the woman, for venereal disease to have made its appearance, in case of her having been infected ?

14. Can you state approximately how long the defendant had been suffering from this complaint ?

15. Can you state approximately how long the woman had been suffering from this (venereal) complaint ?

16. Have you examined the stained articles forwarded to you, and now in Court (No.——Article in Evidence)?

17. What is the result of your examination ?

18. Do you believe that a rape has been committed or not? State your reasons.

No. VIII.

Questions that may be put to a Medical witness in cases of suspected Insanity.

1. Have you examined———-?

2. Have you done so on several different occasions, so as to preclude the possibility of your examinations having been made during lucid intervals of insanity?

3. Do you consider him to be capable of managing himself and his personal affairs?

4. Do you consider him to be of "*unsound mind;*" in other words *intellectually insane?*

5. If so, do you consider his mental disorder to be complete or partial?

6. Do you think he understands the obligation of an oath ?

7. Do you consider him, in his present condition, competent to give evidence in a Court of Law ?

8. Do you consider that he is capable of pleading to the offence of which he now stands accused ?

9. Do you happen to know how he was treated by his friends (whether as a lunatic, an imbecile, or otherwise) prior to the present investigation and the occurrences that have led to it.

10. What, as far as you can ascertain, were the general characteristics of his previous disposition ?

11. Does he appear to have had any *previous* attacks of insanity ?

12. Is he subject to insane *delusion?*

13. If so, what is the general character of these ? Are they harmless or dangerous ? How do they manifest themselves ?

14. Might such delusion or delusions have led to the criminal act of which he is accused ?

15. Can you discover the *cause* of his reason having become affected ? In your opinion, was it *congenital* or *accidental ?*

16. If the latter, does it appear to have come on suddenly or by slow degrees?

17. Have you any reason for believing that his insanity is of *hereditary* origin? If so, please to specify the grounds for such an opinion, and all the particulars bearing on it; as to the insane parents or relatives of the accused; the exciting cause of his attack; his age when it set in; and the type which it assumed.

18. Have you any reason to suspect that he is, in any degree, *feigning* insanity? If so, what are the grounds for this belief?

19. Is it possible, in your opinion, that his insanity may have followed the actual commission of his offence, or been caused by it?

20. Have you any reason to suppose that the offence could have been committed during a *lucid interval*, during which he could be held responsible for his act? If so, what appears to have been the duration of such lucid interval? Or, on the contrary, do you believe his condition to have been such as altogether to absolve him from legal responsibility?

21. Does he now display any signs of *homicidal* or of *suicidal* mania or has he ever done so to your knowledge?

22. Do you consider it absolutely necessary, from his present condition, that he should be confined in a Lunatic Asylum? or again:

23. Do you think that judicious and unremitting supervision *out of an Asylum* might be sufficient to prevent him from endangering his own life, or property of others?

No. IX.

Questions that may be put to a Medical witness in a case of alleged causing Miscarriage (*Sec.* 312-316, *I. P. C.*)

1. Did you examine the person of Mussamut———If so, when: and what did you observe?

2. Are you of opinion that a miscarriage has occurred or not? Give your reasons.

3. In what mode do you consider the miscarriage to have been produced—whether by violence per vaginam, or by external violence, or by the use of irritants *internally*? Give your reasons.

4. It is alleged that a drug called—————was used; state the symptoms and effects which the administration internally of this drug would produce. Do you consider that it would produce miscarriage?

5. Can you state whether the woman was quick with child when the miscarriage was produced? State your reasons.

6. Did you see the fœtus? If so, at what period of gestation do you consider the woman to have arrived?

No. X.

Questions that may be put to a Medical witness in a case of Grievous Hurt.

1. Have you examined———————? If so, state what you observed.

2. Describe carefully the marks of violence which you observed?

3. In what way do you consider the injuries to have been inflicted? If by a weapon, what sort of a weapon do you think was used?

4. Do you consider that the injuries inflicted could have been caused by the weapon now shown to you (No.——Article in Evidence)?

5. What was the direction of the wound; and can you form an opinion as to the position of the person inflicting such a wound, with respect to the person receiving it?

6 Is it possible for such a wound to have been inflicted by any one on his own person? Give your reasons.

The Magistrate in putting this question will show the I. P. Code to the witness; or the Magistrate may vary the form of the question so as to elicit the required information without calling the witness's attention to the I. P. Code.

7. Do you consider that the injuries inflicted constitute any of the grievous hurts defined in Section 320 of the Indian Penal Code? If so, which of them? Give your reasons.

8. Do you consider that the person injured is now out of danger?

9. It is alleged that the injuries were caused by————could they have been caused in the manner indicated?

10. Have you chemically or otherwise examined the stains (on the weapon, clothes, &c.) now before you (No.——Article in Evidence)?

N. B.—In case of the injuries being gunshot wounds, question XXI to XXIV under the head of No. III (Death by wounds) may be put to the witness.

11. Do you believe the stains to be those of blood?

Police Code No. 189.

No.

FROM

THE DISTRICT SUPERINTENDENT OF POLICE,

To

THE CIVIL SURGEON OF

SIR,

I HAVE the honour to request the favour of your examining

sent to the hospital on the

Please fill up the columns on the reverse of this letter and, return it to me with such remarks as you may consider necessary to show clearly your opinion of the cause of

2. All that is at present known of the case is as follows:—

I have the honour to be,
SIR,
Your most obedient servant,

DISTRICT SUPERINTENDENT'S OFFICE,

*The*________________190 .

District Superintendent.

N.B.—Please send me immediate notice if there is any fear of the case terminating fatally, or should unfavourable symptoms set in at any later period, in order that no time may be lost in having the dying declaration of the patient recorded on oath by a Magistrate.

1	2	3	4	5	6
Nature of injury, *i.e.*, whether a cut, a bruise, or a burn, &c., &c.	Size of each injury in inches, *i.e.*, length, breadth, and depth.	On what part of the body inflicted.	Slight, severe, or dangerous.	By what kind of weapon inflicted.	REMARKS.

HOSPITAL,
*The*__________190 .

Civil Surgeon.

Documents which should be forwarded to the Chemical Examiner in connection with suspected cases of :—

HUMAN POISONING.

I.—FATAL—

By Post.—1. *Post-Mortem* Report (No. 1).

NOTE.—Information on the following toxicologically important points should invariably be supplied :—(*a*) date and hour of onset of symptoms ; (*b*) date and hour of patient's death ; (*c*) in cases where the body has been exhumed, the dates of burial and of exhumation should be mentioned. In all cases the entire stomach and contents, with portions of liver and kidney, should be sent. In *dhatura* cases, portions of the small intestine should also be sent.

2. Statement of symptoms supplied by the Police to the forwarding Medical Officer.

3. Note of treatment, if any, adopted in the case (by the Medical Officer, Police, or patient's friends).

4. Police Reports (not Vernacular) sent with the case to the forwarding Medical Officer.

5. Nature of the preservative used. (Rectified spirits to be used except in suspected alcohol, phosphorus, or carbolic acid cases).

6. The seal should, if possible, be a private one, and the same seal should be used throughout.

Under the cover of the box containing the articles for analysis :

1. Memo. stating (*a*) deceased's name and (*b*) number and date of post-mortem report.

II.—NON-FATAL—

By Post.—Medico-legal Form No. II, laying stress on the following :—

(*a*) Symptoms observed by the Medical Officer, or reported by the Police.

(*b*) Note of treatment adopted (if any).

(*c*) Police Reports (not Vernacular) forwarded with the case to the forwarding Medical Officer.

(*d*) Nature of the preservative, if any, that has been used.

Under the cover of the box containing the articles for analysis :

1. Memo. stating number and date of Medico-legal form used, and name of case.

ABORTION CASES.

Fatal.—Same as in fatal human poisoning cases, but, in addition, the uterus should invariably be sent, along with any foreign bodies found in the genital tract.

Non-Fatal.—Same as in non-fatal human poisoning cases, but, in addition, care should be taken to forward any foreign bodies expelled or removed from the vagina or uterus.

BLOOD CASES.

In Blood and Semen cases, particular care must be taken to forward the Magistrate's certificate permitting the removal of exhibits for chemical examination, along with the exhibits.

1. Medico-legal Form No. II.

2. Memo. with name of case and number and date of Medico-legal Form used, to be enclosed along with the articles for examination.

3. The entire garment, &c., must be sent, and a label should be stitched (never gummed, or pasted) to each separate article.

4. Knives or other weapons should bear a label tied on to them and the string should be sealed.

SEMEN CASES.

1, 2, & 3. As in Blood cases.

4. Care should be taken that the cloth be not folded at the stained portion. The stain should be kept quite flat. The stained places should be protected by a thin layer of cotton wool on each surface, as pressure may suffice to crush the spermatozoa beyond the possibility of recognition under the microscope.

5. Where possible, slides should be prepared from vaginal mucus, &c., in cases of rape or unnatural offence (glycerine can be used for mounting the preparations).

CATTLE CASES.

(*Fatal and Non-Fatal,*)

By Post.—1. Medico-legal Form No. II.

2. A sample of the preservative used in the case. (A saturated solution of common salt to be used for cattle cases.)

Under the cover of the box containing the articles for analysis :

1. Number and date of Medico-legal Form used, and name of case.

NOTE I.—In sui-poisoning cases, the punctured portion should always be searched for the needle or its fragments, or any other foreign substance. Such articles should be packed separately.

II.—It is very important that portions of stomach and of liver be sent in all cases.

MISCELLANEOUS.

Attention is also directed to the following points :—

1. Bottles of sufficient size must be used. If viscera are tightly packed into bottles and insufficient space left for the preservative fluid, they will necessarily arrive in a decomposed and probably useless state. The fluid should have free access to every part of the specimen, which should, in fact,

almost float in the fluid, so that no matter in what position the bottle may be placed, the viscera will always be covered by the fluid.

2. Under no circumstances should viscera from different cases be included in the same parcel.

3. If two or more examinations have to be made on the same occasion the Medical Officer should complete one and label and seal the articles connected with it before commencing a second examination, otherwise there is a risk of the viscera, &c., of one case getting mixed with those of another.

4. In cases where the Police send a closed parcel through a Medical Officer, and the latter has no occasion to open it in transmission, the parcel should be placed in a second cloth-cover and the memo. referred to in the above instructions should be placed under this fresh cover. This procedure is necessary in order to prevent cases getting mixed up on receipt in the Chemical Examiner's Office.

5. The impression of the seal attached to forwarding letter should be protected on both sides by a thin layer of cotton-wool to prevent the wax being powdered in transit.

6. The labelling and numbering of articles should not be in the Vernacular, but in English.

CHEMICAL EXAMINER'S OFFICE, C. H. BEDFORD, *Capt., I.M.S.,*
Calcutta, 1st April 1901. *Chemical Examiner to Government, Bengal.*

20, B. C. M. D.

I.

FORM IN WHICH TO REPORT POST-MORTEM EXAMINATIONS, TO BE USED WHEN FORWARDING VISCERA TO THE CHEMICAL EXAMINER.

FROM THE ______________________________

TO THE ______________________________

____

Dated ______________________________ 189 ____

Description of viscera forwarded for examination.

Mode of packing. Weight of parcel.	Copy of label attached to bottle.	Impression of seal.
Mode of despatch.	Date of despatch.	Date of receipt in Chemical Examiner's Office.

Information furnished by Police, or *précis* of case.

Name ______________ sex ________ age ________ caste ________ of

thana or village ______________________________

History of case—*continued.*

Date and hour of despatch of body. Date of receipt	Date and hour of autopsy.	Name of officer by whom examination was actually made.

Appearance of body—

Muscularity

Stout

Emaciated

Special marks—

Scars

Tattooing

Amount of hair, &c.

Signs of decomposition—

Wounds and bruises—

a.—Position

b.—Character

c.—Size

State of natural orifices—

- Eyes
- Ears
- Nostrils
- Mouth
- Vagina
- Anus
- Urethra

State of limbs, &c—

- Rigor mortis
- Position
- Contents of hands, if clinched
- Features ...
  - Relaxed
  - Contracted
- Eyelids
- Pupils
- Contents of mouth
- Position of tongue
- State of teeth

Thorax—

- Ribs
- Cartilages
- Pleura
- Pericardium
- Heart ...
  - Shape and appearance
  - Cavities
  - Clots, *ante* or *post-mortem*
  - Muscular structure
- Vessels ...
  - Clots
  - Aneurism
  - Atheroma, &c.
- Lungs ...
  - Appearance
  - Colour
  - Consistence
  - Adhesions
- Larynx, trachea, and bronchi for foreign bodies or disease

Abdomen—

- Peritoneum
- Peritoneal cavity, contents
- Liver and gall bladder—form and size, disease or injury
- Pancreas, disease or injury
- Spleen, ditto ditto
- Kidneys, ditto ditto
- Stomach ...
  - Size and general appearance
  - Appearance of coats
  - Contents, appearance, odour, and quantity
- Intestines ...
  - General appearance and contents
  - Appearance of coats

Generative organs—

Bladder and contents

Uterus, appearance, size and contents

Vagina, contents

Head—

Scalp

Bones, disease or injury

Membranes

Brain substance and ventricles

Base of skull fractures, caries, extravasation, &c., &c.

The spinal canal need not be examined, unless any indication of disease or injury exist.

Fractures and dislocations—

More detailed description of injury or disease.

OPINION AS TO CAUSE OF DEATH

*Station*________________

*Dated*________________ *Civil Surgeon or Medical Officer of*__________

20*a*, B. C. M. D.

II.

FORM OF REPORT TO BE USED WHEN FORWARDING SUBSTANCE OTHER THAN VISCERA TO THE CHEMICAL EXAMINER.

No. ________________

FROM THE ____

TO THE CHEMICAL EXAMINER TO GOVERNMENT,

____

Dated ________________________ *189* .

FORWARDING the articles mentioned below for examination for ________

____ in connection with the case of ______

____

DESCRIPTION OF ARTICLES.

Mode of packing and weight of parcel.	Copy of label and impression of seal.
Mode of despatch. Date	Date of receipt in Chemical Examiner's Office.

Facts of Medico-legal Importance in connection with the Case.

*Signed*____________________

Certificate to be signed by a Magistrate or other Judicial Officer and forwarded with Blood or Seminal stained exhibits.

CERTIFIED that a Chemical Examiner to Government has permission of the Court to remove, if necessary, portions of the exhibits connected with the case of Empress *versus*____ for the purpose of applying chemical tests.

Signed

Deputy Magistrate.

NOTE.—This certificate must be signed by a Magistrate or other Judicial officer, and is to be appended by the Chemical Examiner to his report on the case and filed with the records.

Executive New No. 89 (Old No. 97).

No. 2.

Certificate of Medical Officer in the Form A in the Schedule to Act No. XXXVI of 1858.

I, the undersigned, (1)

hereby certify that I on the day of

at (2) personally examined (3)

and that the said

is a lunatic (4) and a proper person to be taken charge of and detained under care and treatment, and that I have founded this opinion on the following grounds, namely—

(1) Name, official designation, or medical qualifications.
(2) Name of place.
(3) Name and residence of lunatic.
(4) Or an idiot, or a person of unsound mind.

1*st.*—Facts indicating insanity observed by myself.

2*nd.*—Other facts (if any) indicating insanity communicated to me by others (5).

(5) Name and address of informants.

The 190 . } *Civil Surgeon.*

Government of Bengal, Executive Form No. 90.
High Court Criminal No. (M) 118.
High Court Civil Miscellaneous No. 149.

FORM OF MEDICAL HISTORY SHEET OF LUNATICS.

HIGH COURT'S RULE NO. 2, DATED THE 29TH OCTOBER 1896—(CRIMINAL).
HIGH COURT'S RULE NO. 5, DATED THE 29TH OCTOBER 1896—(CIVIL).

(*If any of the particulars in this statement be not known, the fact to be so stated.*)

1. Name of patient in full and caste or race.
2. Name of patient's father.
3. Sex and age of patient.
4. Marks whereby the patient may be identified.
5. Married or single or widowed.
6. Condition of life and previous occupation (if any).
7. Religion.
8. Place of birth and recent place of abode.
9. Whether homeless or living with relatives or friends.
10. Previous history and habits.
11. State of bodily health.
12. Whether any member of patient's family has been or is affected with insanity.
13. Whether the attack is the first attack of insanity or not.
14. Age (if known) at onset of first attack.
15. Duration and nature of any previous attacks.
16. Duration of existing attack.
17. Symptoms exhibited.
18. Supposed cause of insanity.
19. Supposed exciting cause of present attack.
20. Whether subject to epilepsy.
21. Whether suicidal.
22. Whether dangerous to others.

Executive New No. 88 (Old No. 96).

CIVIL SURGEON'S CERTIFICATE OF LUNATIC'S HEALTH AND FITNESS FOR REMOVAL TO ASYLUM.

No.

Certified (duplicate) in accordance with the Rules laid down in Government letter No. 4382, from the Officiating Additional Secretary to the Government of Bengal, to all Commissioners (except the Commissioner of the Presidency Division), dated Fort William, the 5th September 1868.

I, , Civil Surgeon of

do hereby certify that I have this day examined the (1) — (1) Lunatic, idiot, or person of unsound mind.

named aged and that the said

is in a (2) state — (2) Good, fair, weakly

of health, and is physically (3) to be — (3) Fit. (4) Conveyance.

forwarded by (4) to the Lunatic

Asylum at

The this day weighs

DATED

The 190 . *Civil Surgeon.*

Date of arrival

Apparent condition of health

Any mark of violence that may be perceptible.

Officer in charge of Police Station.

On arrival at the Asylum

and weighed

Dated } *Superintendent,*
The 190 . } *Asylum.*

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